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WHEAT AND ITS CULTIVATION.

No. 10.—WHEAT IMPROVEMENT.*

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(*Continued from page* 56.)

The second method of effecting specific improvements in plants is by means of cross-breeding or hybridization.

In effecting improvements by cross-breeding the mode of procedure is to cross two varieties of wheat possessing divergent and complementary characteristics, and selecting from the widely varying progeny those particular individuals which possess in the highest degree the specific qualities which we are seeking.

In order to effectually apply such a method it is necessary to have a clear conception of the goal towards which improvement is to be wrought, a knowledge of the unit characters of the different varieties, and of the laws governing the inheritance of these unit characters.

The act of crossing, and the actual production of merely new varieties is simplicity itself—the fixing and production of valuable varieties is extremely difficult.

STRUCTURE OF THE WHEAT FLOWER.

Before discussing the method of crossing wheats, let us consider briefly the structure of a flower of wheat. The " head " or " ear " of wheat is known in botanical language as a spike, and consists of a flattened stem or rachis bearing alternately a series of structures known as " spikelets." Each " spikelet " or " chest " consists of several flowers. Usually each spikelet of most varieties has three to five flowers, from each of which a grain of wheat may develop. The flower itself consists of two parts—

(*a*) the protective parts, consisting of glumes and pales.

(*b*) the essential parts—the stamens and pistil—*i.e.*, male and female organs. (Fig. 1.)

* Portions of this and the previous article formed a paper read at the Australasian Association for the Advancement of Science, January, 1913.

We are concerned here especially with the essential organs. The stamens (St.) are three in number, and represent the male organs. Each stamen consists of a slender stalk—the filament, bearing at its summit the anther or pollen sacs, which in the case of the wheat plant consists of four longitudinal chambers containing large numbers of minute pollen grains (sperm cells).

The female portion of the flower—the pistil—consists of the ovary with a minute ovule (or egg cell). The upper part of the ovary bifurcates and forms two long, slender, feathery structures—the styles. (Fig. 1).

The pollen grain falls on the stigma of the flower and " germinates " sending a slender prolongation through the style until it reaches the ovule when fusion and fertilization takes place.

How the crossing is done. In the case of the wheat plant the flowers are normally self-fertilized. Natural cross fertilization is very rare. Moreover the flowers are hermaphrodite, *i.e.*, male and

FIG. 1.—FLOWER OF WHEAT (MAGNIFIED).

female elements are borne on the same flower. The wheat plant is said to be in " flower " when the anthers begin to extrude from the glumes. With wheat, however, fertilization takes place before " flowering." In order to cross one variety with another it is necessary that the pollen of one variety should be dusted on the ripe stigma or female part of the second variety. The plant from which the pollen is taken is generally described as the male parent, whilst the plant on which the crossing is done is referred to as the female parent. I find the following method gives satisfaction. A well developed " ear " of the "female parent " is chosen and prepared in the following manner:—

The basal spikelets amounting to approximately one-third of the ear are stripped off, and the top third of the head removed with a pair of scissors. About four or five spikelets are thus left on each side of the centre of the ear. These spikelets invariably contain three to five flowers. All flowers save the outside pair are removed with a pair of

forceps. Thus the ear is reduced to twelve to twenty flowers (Fig. 7). It is now necessary to "castrate" the flowers by removing the three anthers from each. The point of the forceps is gently inserted between the upper margins of the inner and outer pales, and, by releasing the pressure on the forceps the flower is gently forced open exposing the three anthers and the feathery stigma. With a little practice these anthers may be removed unbroken with one stroke of the forceps. It is, of course, necessary to prepare the ear in this fashion before any of the anthers have shed their pollen grains. The best stage at which to carry out the operation is when the anthers are just approaching maturity and turning yellow in colour. Having castrated the whole of the flowers by the removal of all traces of the anthers, the ears may be wrapped in cotton wool until the *stigmas of the flower become "receptive" or ready to receive* the pollen. The cotton wool may then be removed, and ripe anthers of the particular variety desired as the male parent should then be secured. The anthers should be quite "ripe" *i.e.*, bright yellow in colour, and just ready to burst. The anthers are seized with a fine pair of forceps, broken in halves, and the contents gently shaken or dusted over the feathery style of the female ear. Each flower is treated in succession in this way, and frequently, when the pollen is not in good condition, some of the anthers may be broken and left inside the protective glumes of the flower.

Instead of castrating and pollinating the flowers on different days it is generally more convenient to remove the anthers and cross-pollinate the stigmas at the one operation. It is necessary in such cases that the stigma and anthers should be fairly "ripe," and care should be taken that self-fertilization does not occur. Any flowers in which the anthers have already *liberated pollen should be suppressed.*

After the crossing is finished the ear is wrapped up in cotton wool, or surrounded with a light paraffined paper bag to prevent the possible entry of foreign pollen. The ear is then labelled with the names of the male and female parents, date of cross, &c., and supported by a stake (Fig. 8). A fortnight later the protective covering may be removed, and the ear allowed to ripen.

EFFECTS OF CROSSING.

It is interesting to note, in passing, the general effect of crossing two different varieties of wheat:—

(a) Crossing Increases Vigor of Progeny.

Darwin made an exhaustive comparative study of the effects of self-fertilization and cross-fertilization in plants. He has summed up his researches in the generalization that "**Nature abhors perpetual self-fertilization.**" He showed that crossing within the limits of the species resulted in the production of a very vigorous offspring, while self-fertilization tends to weaken the offspring, and that flowers as a general rule

are constructed in such a manner as to favour cross-fertilization. In the case of wheat, however, it must be remembered that the flowers are normally self-fertilized, and that cross-fertilization under natural conditions is extremely rare. There can be no doubt that in the cross-breeding of wheat the immediate effect is a general marked increase in the vigour of the cross. This increased vigour finds its expression generally in increased height, increased stooling capacity and size of head in the cross-bred progeny. Whether this increased vigour is, however, a permanent characteristic or a mere temporary improvement has not been definitely established in the case of wheat.

(*b*) *Crossing "breaks the type"* and induces variation. Cross-breeding is one of the most powerful methods of inducing variations in a given type. There is no variety of wheat grown at the present time but what has some serious defect. It frequently happens that given varieties are specially well dowered with certain desirable qualities, but are sadly deficient in other necessary qualities. It is now possible by systematic cross-breeding to combine the desirable qualities of two or more individual types in one variety, and eliminate any undesirable qualities. Farrer relied almost entirely on this method for the production of his new varieties. Federation, the most popular and prolific wheat in general cultivation in Australia at the present time: Cedar, Bobs, and Comeback, wheats of the highest milling excellence; Florence and Genoa, varieties which are smut resistant; and Bunyip, Thew, Bayah, Firbank, Warren, Jonathan, and a host of others have been produced by Farrer by means of cross-breeding. It is by means of the variations induced by crossing that improvement on existing types becomes possible.

Obviously, the wider initial differences between the two plants the more widely will the progeny vary.

Do the Variations Follow Definite Laws?

Some idea of the difficulties which beset the early workers on this field of inquiry may be gathered from the history of a typical cross-bred seed. Suppose, for example, the variety known as Clubhead, which is a stiff-strawed, beardless, dark-chaffed variety with a dense compact head, be crossed with Yandilla King, which has a long, white, somewhat open head with firm closing glumes. The plants of the first generation will invariably be slightly clubby in character with reddish-brown chaff. Now from this single cross-bred plant a thousand seeds might be produced. If every one of these seeds be separately sown the next season an unending variety of plants will arise.

Every gradation and combination between the characteristics of the Clubhead on the one hand and the Yandilla King on the other appear to make themselves manifest in this generation. Indeed, characters appear in this generation which were latent in the

originals, *e.g.*, many of the progeny will be found with beards. Apparently chaos is the result of this simple act of crossing. Further, if a few grains be selected from each of the thousand plants and again be sown separately, it will be found that in the third generation some of the plants breed true to type whilst others give still further complex variations. This apparently chaotic result arising from the growing of a single cross-bred seed puzzled and confounded the early hybridizers and investigators. If by cross-breeding plants possessing specific characteristics the progeny were found to obey no definite laws it follows that the improvement of plants by this method would be nothing more than a mere gamble.

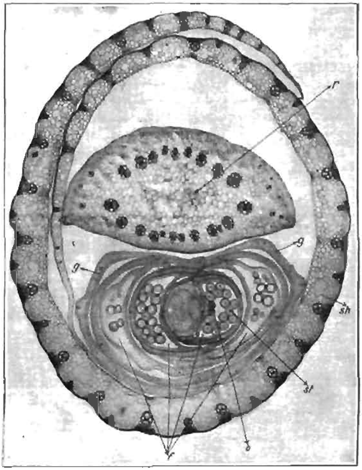


FIG. 2.—TRANSVERSE SECTION THROUGH SPIKELET OF WHEAT SHOWING RELATION OF PARTS.

r, Rachis or Stem; *f*, Flowers; *st*, Stamen of Flower; *a*, Ovary of Flower; *g*, Glumes; *sh*, Sheath.

Lindley, indeed, some fifty years ago, declared that the improvement of plants by cross-breeding was a game of chance with the odds in favour of the plant.

If, on the contrary, the laws of inheritance of specific characteristics could be formulated and definitely known it manifestly follows that the work of plant improvement would be reduced to scientific exactness.

Gregor Mendel, monk and abbot, of Brunn, in Austrian Silesia, was the first to unravel this tangle, and present to the world a clear and lucid exposition of the inheritance of specific characters in cross-breeding.

Mendelism.

Mendel communicated the results of his now world-famous experiments to the local scientific society in 1865, but, strangely enough, they lay unnoticed until 1900, when they were rediscovered and independently confirmed by De Vries, Correns, and Tschermak.

Mendel realized that the failure of the early hybridizers to elucidate the general principle of inheritance from the results of cross-breeding was due to the fact that they did not concentrate their attention on definite characteristics of the plant, and trace the inheritance of these characteristics through a sequence of generations. After a great deal of experimenting he decided to use the common pea for his investigations. A close examination of the different varieties in cultivation enabled him to separate 22 distinct types. He arranged these pure races *into pairs of opposite or contrasting* characters and crossed representative plants of each pair separately. Thus he crossed tall peas with dwarf peas, peas with angular seeds with those *possessing rounded seeds, &c.* He carefully preserved all the progeny of every cross-bred plant and planted them separately each year. In the case of the cross between the tall and dwarf pea, the progeny of the first generation were all talls. This property or character of tallness, Mendel, therefore, described as dominant, whilst the opposite attribute dwarfness, which appeared to be masked, he described as recessive. The plants *of this generation were allowed to* fertilize themselves, and the offspring of each plant were separately sown. In the second generation it was found that one-quarter of the progeny *regularly resembled the recessive* parent, and constantly bred true to type. The remaining three-quarters of the progeny resembled the dominant parent. That is to say, there were three times as many talls as there were dwarfs in the second generation of the hybrid. It was found that the recessives bred true to type for countless generations, *i.e.*, they always gave rise to plants that were dwarf in character. The dominants, however, when allowed to fertilize themselves did not all breed true, but gave rise to plants of two kinds—

Fig. 3.—Pollen Sac (Anther) Containing Numerous Pollen Grains (x 40).

(*a*) *Impure* dominants which in the next generation gave a mixture of both talls and dwarfs in the proportion of three talls to one dwarf.

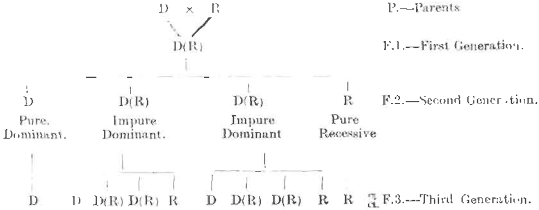
(*b*) *Pure dominants* which produced talls only, and were thus pure to tallness.

Moreover, statistical examination of these two types revealed that there were *exactly twice* as many impure dominants as there were pure dominants. In other words, the third generation of the original hybrid consisted of three different types of plants.

Pure Dominants 25% — Impure Dominants, 50% — Recessives, 25%

3 Dominants *1 Recessive*

These interesting results obtained during the first three generations by crossing the tall and the dwarf peas may be summarized by the following diagram, where D represents a true breeding tall plant—the Dominant character, and R the Recessive character, a pure breeding dwarf plant; and D(R) an Impure Dominant, *i.e.*, a tall which on self-fertilization gives both talls and dwarfs in the ratio of 3:1.



Besides tallness and dwarfness other contrasted pairs of characters were experimentally dealt with, and it was found that they followed the same law of inheritance. Thus coloured flowers were found to be dominant to white, and the first generation consisted of coloured flowers. In the second generation there were three times as many coloured flowers as white. The white flowers were found to breed true to type, but of the coloured flowers the ratio of pure types to impure types was as 1 : 2.

One naturally wonders what would happen if two plants possessing two pairs of contrasting characters were crossed together. For example, suppose a tall pea with coloured flowers were crossed with a dwarf pea with white flowers, how would the respective characters be distributed in the progeny? In this Mendel found that each pair of characters followed the same rule, and that the inheritance of each was quite independent of the other.

When the tall coloured pea was crossed with the dwarf white pea, the progeny of the first generation were all tall coloured plants, for tallness was dominant to dwarfness, and coloured flowers were dominant to white.

When this hybrid was self-fertilized the second generation gave four kinds of plants, namely, coloured talls, coloured dwarfs, white talls, white dwarfs. Further, it was found that the plants with coloured flowers were three times as numerous as those of the plants

with white flowers. Similarly there were three times as many talls as dwarfs. In this generation, the four forms were actually found to be present in the following ratios, namely:—

9 coloured talls, 3 white talls, 3 coloured dwarfs, 1 white dwarf. And this is the only ratio which can satisfy the condition that the coloured should be to the white as 3:1, and at the same time the talls should be to the dwarfs as 3:1. These results may be concisely summarized as follows:—

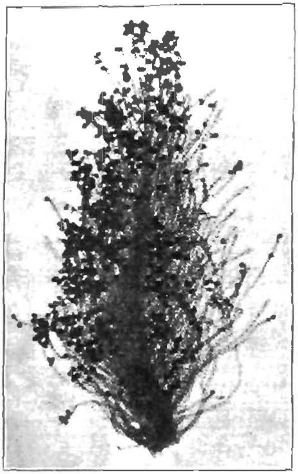


FIG. 4.—STIGMA OF WHEAT FLOWER SHOWING ADHERENT POLLEN GRAINS (x 25).

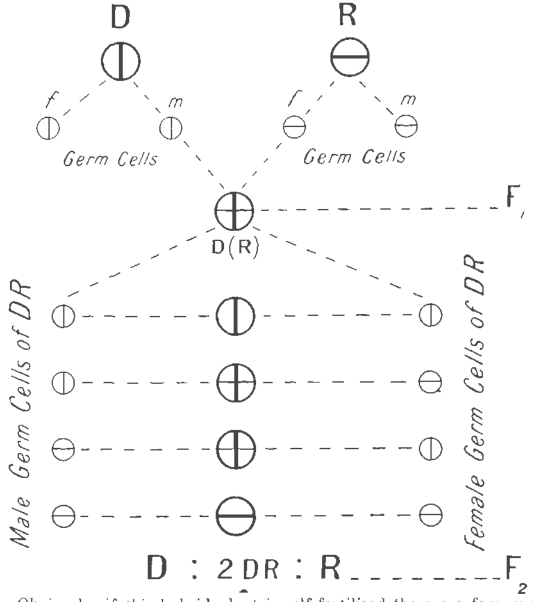
When two plants exhibiting two pairs of contrasting characters are crossed together, the progeny of the first generation consists of plants bearing the two dominant characters, whilst in the second generation the characters segregate with the following proportion:—Nine plants possessing *the two dominant characters*; three plants exhibiting one dominant and one recessive; three plants exhibiting the other dominant and the other *recessive*; and only one plant with both the recessive characters. This principle may be extended to three or more pairs of different characters.

WHAT WAS MENDEL'S EXPLANATION OF THESE FACTS?

After Mendel had experimentally determined the scheme of inheritance for each of the seven pairs of differentiating factors which engaged his attention, he attempted to provide a theoretical interpretation to fit in with the observed facts. He assumed in the first place that each germ cell or gamete could carry a factor which could give rise to one or other of the differentiating pair of characters, *e.g.*, any given germ cell could carry the attribute or factor either for tallness or for dwarfness, but *not for both*.

These two attributes were mutually exclusive so far as the gametes are concerned. When a pure tall plant produced gametes or germ cells each bore the attribute for tallness. Similarly the gametes of the dwarf plants all bore the attribute of dwarfness. When the tall pea is crossed with the dwarf pea a gamete bearing the attribute of tallness mates with a gamete bearing the attribute of dwarfness. Inasmuch as the attribute of tallness is dominant, the hybrid progeny will be in appearance similar to the pure tall plant. This hybrid

tall, however, will differ markedly from the pure tall plant when it produces gametes. Mendel assumed that when it forms gametes the elements representing tallness and dwarfness segregate from one another, and of the total number of gametes formed one-half contains the one element, and one-half the other. That is to say, when this hybrid plant forms its germ cells—pollen grains and egg cells—one-half of the pollen grains will possess the dominant character, and one-half the recessive character. Similarly one-half of the egg cells (ovules) will carry the dominant attribute, and one-half the recessive.



Obviously, if this hybrid plant is self-fertilized there are four and only four combinations possible, namely:—

(*a*) A dominant pollen grain with a dominant egg cell. DD.
(*b*) A dominant pollen grain with a recessive egg cell. DR.
(*c*) A recessive pollen grain with a dominant egg cell. DR.
(*d*) A recessive pollen grain with a recessive egg cell. RR.

and the proportion of each must be:—

DD: 2DR: RR.

which corresponds to Mendel's Law.

The above schematic representation may assist in making this clear:—

CONFIRMATION OF MENDEL'S RESULTS.

Mendel's work has been confirmed by many workers in widely different fields of investigation. Besides Correns, Tschermak, and De Vries, who were responsible for the rediscovery of Mendel's work, there have been confirmatory contributions by Darbishire on Mice, Hurst on Rabbits, Davenport on Poultry, Vilmorin, Nillson-Ehle, Biffen, Spillman, and Howard on Wheat, Bateson, Saunders, and others on Lychnis, Atropa and Matthiola, and Toyama on Silkmoths.

CAN THESE PRINCIPLES BE APPLIED TO THE BREEDING OF WHEAT?

It is of great practical importance to know whether the laws of inheritance already formulated may be applied in practice to the improvement of wheat. A considerable amount of data has accumulated during recent years on the inheritance of unit characters in wheat, and this tends to show that—

(1) The process of "fixing" new crosses, which formerly required considerable time and a vast amount of labour, may be greatly simplified.
(2) The wheat breeder can predict with a tolerable amount of certainty what combinations of unit characters may be associated and fixed in a new variety.
(3) The breeding of new varieties possessing certain specific attributes and desirable qualities may be accomplished with certainty.

The most prominent investigators in this field of work are Tschermak,* Spillman,† Biffen,‡ Nillson-Ehle§, and Howard‖. The first essential of course is to determine what characteristics in wheat are dominant and what recessive. *Tschermak** after an exhaustive and critical study of the behaviour of the various contrasted unit characters in wheat states that the following attributes are respectively dominant and recessive, in strict accordance with Mendel's law:—

Table of Contrasted Characters in Wheat (Tschermak).

Dominant.	Recessive.
Hairy leaves.	Smooth leaves
Solid stem.	Hollow stem.
Firm closing of glumes.	Loose closing of glumes.
Felted glumes.	Smooth glumes.
Black chaff.	White chaff.
Flinty grain.	Floury grain.
Winter form (late shooting)	Spring form (early shooting)
Lax ears.	Dense ears.

These have been confirmed in general by Biffen and Spillman, though in the case of bearded and beardless wheats the ratios are often very far from following Mendel's law, as Saunders,** Howard,†† and others have pointed out.

* *Tschermak*—Die Zuchtung der landw. Kultur Pflanzen Bd. IV. 1907.
† *Spillman*—Science XVI. 1902.
‡ *Biffen*—Journal of Agric. Science 1905, 1907, 1908, 1909.
§ *Nillson-Ehle*—Kreuzungsuntersuchungen an Hafer and Weizen Lund, 1909–1911
‖ *Howard*—Memoirs of the Imperial Dept. of Ag. India, Vol. IV., No. 8, Vol. 5, No. 1.
** Saunders' Inheritance of Awns in Wheat. Conference on Genetics, 1906, p. 370.
†† Howard (*loc. cit*).

Biffen has obtained similar results at Cambridge. In addition he has shown that the following characters behave as Mendelian units:—

Dominant.	Recessive.
Red Grain.	White Grain.
Hard Translucent Endosperm.	Soft Opaque Endosperm.
Susceptibility to yellow rust.	Immunity from yellow rust.

In the following characters there is no dominance of either character, and the progeny in the first generation are intermediate:—

Lax and dense ears.
Large and small glumes.
Long and short grains.
Early and late ripening.

In the second generation two of the intermediates occur to each pure character. D : 2 DR : R.

The determination of the mode of inheritance of these various unit characters is of the greatest practical importance, for it enables the breeder to predict with tolerable certainty the forms resulting from the mating of two plants whose qualities can be expressed in terms of one or more unit characters.

FIG. 5.—STIGMA OF WHEAT FLOWER HIGHLY MAGNIFIED SHOWING NUMEROUS ADHERENT POLLEN GRAINS.

One of the most interesting of the researches carried out in the production of new varieties of wheat is that done by Biffen in the production of the apparently impossible combination in the one variety of prolificacy, resistance to yellow rust, and high strength.

The wheats grown in England are very low in strength, and this defect is reflected in the disparity in price at Mark Lane between the Home-grown wheat, and the strong foreign wheats like Manitoba No. 1. It was formerly thought that this low strength of the wheats grown in England was due to the peculiarities of the climate.

A trial of a large number of foreign varieties of high strength under English conditions proved that while the greater majority deteriorated immediately, there were a few varieties which retained their strength perfectly under the new climatic conditions, and gave as good results in the bakehouse as when grown in their native lands. These varieties, however, were of little use to English farmers, for

they lacked yielding power of both grain and straw. Biffen, therefore crossed these varieties of high strength with the prolific English varieties with the object of obtaining suitable varieties of high strength. Strength is defined as to the capacity of the flour "to yield large well-piled loaves,"* and while it is not an easy matter to give in non-technical language the difference in strong and weak wheat, it may be said that in general strong wheats are characterized by hard more or less transparent endosperm, whilst weak wheats are usually soft, starchy, and opaque. In a certain cross between Red Fife and Rough Chaff a statistical examination of that progeny revealed the fact that in the first generation all the plants possessed strong grain, and that in the second generation the strength and weakness behaved as Mendelian characters giving the following ratio:—Nine strong red, three strong white, three weak red, one weak white. Biffen showed that these characters of strength and weakness in wheats could be handled with the same definiteness as other Mendelian characters.

FIG. 6.—STIGMA OF WHEAT FLOWER HIGHLY MAGNIFIED SHOWING POLLEN GRAIN IN THE PROCESS OF FERTILIZING THE OVULE.

Similar results were obtained with the inheritance of yellow rust (*Puccinia glumarum*) which does great damage in England.

Crosses between varieties which were immune from yellow rust and Michigan Bronze, a variety inordinately prone to rust, gave a first generation crop of hybrids which were as badly affected with rust as Michigan Bronze itself. A statistical examination of the second generation plants gave 1,603 diseased plants and 523 immune, or a ratio of 3.07 : 1. Apparently, therefore, immunity and susceptibility to yellow rust behave like Mendelian characters.

It is not known to what the resistance of the rust is due. Working with Professor Biffen Miss Marryat found that the rust hyphæ are checked after entering the stomata of the resistant plants. Bateson points out that if the resistance to yellow rust is due to the presence of some anti-toxin the dominance of susceptibility must be taken to indicate that the formation of the anti-toxin is prevented by the presence of a factor in the dominant form, a conclusion which may lead to definite progress in the physiology of disease resistance. This yellow rust (*Puccinia glumarum*) is not the rust so frequently

* T. M. Wood, Chemistry of Wheat and Flour, *Journal of Agri. Science*, 1907.

found in Australian wheat fields. The species of rust which causes so much damage here is *Puccinia graminis*.

Many of the unit characters so far studied in wheat have been those which are of relatively little value to the practical agriculturist. The colour of the chaff, the character of the awns, the hairs on the glumes, &c., are of great interest from a scientific point of view, inasmuch as a systematic study of them will serve to throw much light on obscure problems of inheritance, but they are of infinitely less practical utility than such characteristics as prolificacy, drought resistance, and early maturity.

FIG. 7.—HEAD OF WHEAT PREPARED FOR CROSSING.

a. Before Treatment.
b. Same head after treatment. Showing suppression of upper and lower spikelets and portion of median spikelets.

Unfortunately very little work has been done in regard to these important practical properties, and a systematic analysis of the factors on which these qualities depend, and of their mode of inheritance is urgently required. We do know that the prolificacy of any variety of wheat is a complex of many factors. The yield depends on the climate; the chemical, physical, and biological condition of the soil; and on the qualities inherent in the variety.

Of the qualities inherent in the variety the most important are the capacity to develop a vigorous root system, and to stool strongly. Other factors are the average length and density of the ears—the number of fertile florets carried to each spikelet, and the average size of the grain. We do not know, however, as yet whether high yielding and low yielding capacity behave as Mendelian characters and segregate as such in the second generation.

The production of drought-resisting wheats is a problem of peculiar importance to Australia, since the expansion of the margin of profitable cultivation is largely dependent on what success can be achieved in the confines of our existing wheat areas. It is a matter of common observation that among the many varieties of wheat that are grown at present there are some that could not be expected ever to do well in the dry areas. These are the very late varieties, and those which produce an abundance of foliage. Varieties such as Manitoba, Red Fife, Power's Fife, Huron, Marquis, &c., ripen far too late to be of value in our dry areas. While a great deal may be accomplished by scientific effort in the production of new varieties suitable for our driest areas, it is not reasonable to expect that more would be accomplished in a decade in this way, than by centuries of care by past generations of wheat-growers under arid conditions.

That is to say, the production of drought-resisting varieties is likely to be successful if we use as foundation stocks those varieties

which have been grown for generations under the very driest conditions. Among wheats that might be useful in this direction are the durum wheats, and certain early maturing varieties which are regularly grown under arid conditions in India.

Such varieties growing habitually under arid conditions might be expected to develop qualities which inure them to their environment. In the course of generations these qualities of resistance to arid conditions might be expected to become hereditary. Structural changes might be expected to develop such as increased root system, diminishing leaf and transpiration surface, and possibly a decrease

FIG. 8.—CROSSING WHEATS AT RUTHERGLEN EXPERIMENT FARM, 1912.

in the size and number of stomata per unit area, and a decrease in the proportion of straw to grain.

If to such qualities as these that of rapid maturity could be added we should have varieties which might be expected to do well in a dry and rigorous climate such as obtains on the confines of our wheat areas.

Some six years ago a large number of Indian varieties were obtained by the South Australian Department for trial at Parafield. Many of these proved to be of little value, but there were nine varieties in all from the Punjaub which were remarkable for the

extreme earliness of ripening and their resistance to droughty conditions. These wheats usually grow 12 inches to 15 inches high, but they are remarkable for the small amount of narrow upstanding flag produced in comparison with the grain. Moreover, these Indian varieties are extremely early, and by cross-breeding them with some of our local varieties it has been possible to produce new varieties which mature considerably earlier than the variety on which they were crossed.

The value of early maturing varieties in a dry season such as we have experienced in Victoria during 1912 must be obvious.

Compared with late maturing varieties the early varieties are able to make vigorous growth, and get well on the way towards maturity, and beyond reach of injury before the hot dry winds of early summer come on.

Grass Tuft Wheats.

In the raising of cross-bred varieties it frequently happens that certain of the crosses bear in more or less regular ratio a number of peculiar, stunted looking plants, which at first sight appear to be tufts of grass. These grass-like tufts, however, are really wheat plants of a very inferior character. They usually contain numerous crowded leaves, narrower, shorter, and more erect than

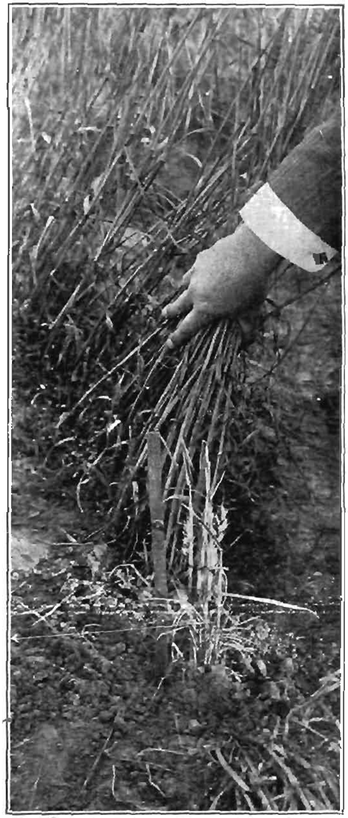


FIG. 9.—GRASS TUFT WHEAT PLANT SHOWN BY ARROW.
Rutherglen Experimental Plots, 1912.

ordinary wheat plants, and, though they generally die off before heading out, occasionally give rise to a few short stunted-looking heads. It may be thought that these plants have resulted from defective nutrition, and that for this reason the plant was not able to complete its structure: in other words, that they are merely cases of arrested development.

The fact that these grass tuft plants occur regularly in the second and third generations of certain wheat crosses, and are not found in the standard varieties of wheat grown under similar soil conditions indicates that the cause must not be looked for in the environment.

At Longerenong, during 1912, out of 15,800 plants sown in the cross-bred hand plots 28 grass tuft wheats were observed, whilst not a single plant was observed in the 35,000 plants in the standard selection plots. At Rutherglen 45 such plants appeared in 18,500 cross-bred plants, while none appeared in ordinary variety plots. The tufts appeared on twelve different crosses, of which six were crosses with Indian wheats. The average height of the tufts was 9 inches. Less than 50 per cent. formed heads, and only 9 per cent. formed grain. Farrer* observed a number of these grass clumps in his cross-bred plots from time to time, and noted that the grass clump plants were "produced in the greatest number by first crosses between widely different types of bread wheats (*T. Sativum*), and appear to be produced by crosses between bread wheats alone."

Farrer planted a number of seeds from these grass clump plants, and found that while in some cases all were grass clump plants, in others the seeds gave mixtures of grass clumps and wheat plants. He assumes that these are "reversions," and suggests that a systematic experimental investigation of these grass clump plants would probably make known to us the number of species from which the different cultivated bread wheats are descended, and would give a clear idea of the botanical characters of these ancestors, and enable us to identify any that may still be in existence.

Conclusion.

During the past few years efforts have been made by ardent enthusiasts to extend Mendel's law to all branches of animal breeding, and to make it fit in with our present day knowledge. Interesting results have certainly been obtained in the cross-breeding of poultry, mice, rabbits, and polled cattle, but a considerable amount of ingenuity will be required to explain many of the discrepant and discordant results obtained with sheep and pigeons, &c.

Whatever the future may have in store in the practical application of Mendel's work to Animal Breeding, there can be no doubt that the present day breeder can, with the aid of the key given by Mendel, proceed on his work of plant improvement without leaving much to chance. The best results will follow when the individual plant is regarded as being built up of a number of unit characters, each of which follows a definite scheme of inheritance. The terms dominance and recessiveness should be applied, not to individual plants, but to each of the unit characters which collectively make up

* Farrer, "The Making and Improvement of Australian Wheat," *Agricultural Gazette of New South*

the organism. The scheme of inheritance of many of the unit characters have been worked out in detail, but there are qualities of

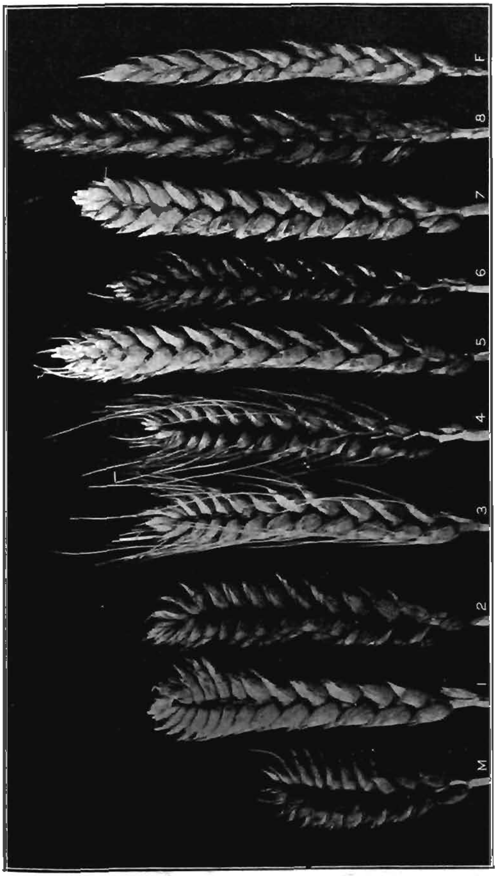


FIG. 10.—CROSSBRED TYPES PRODUCED BY MATING CLUBHEAD (MALE PLANT) WITH YANDILLA KING (FEMALE PLANT).

M, Club head (bronze red); F, Yandilla King (white); 1, 2, 3, 4, 5, 6, 7, 8, Some of the second generation crossbred progeny, showing variations in colour and structure of head.

great practical importance which require further investigation. We require to know exactly what are the various factors on which these important qualities depend, whether they conform to the Mendelian scheme of inheritance, and whether they are transmitted independently of other factors, or in association, and, if so, how close the association is.

The aim of the wheat-breeder is always an improvement in type, the production of varieties possessing the maximum of desirable qualities, and the minimum of undesirable attributes. If he knows that the desirable qualities he is seeking are in two or more strains it is his task to unite the desirable qualities in the one strain. His most important problem is to determine by analysis and experiment the factors on which the desirable characteristics depend. But as soon as these factors have been determined, and their mode of inheritance investigated, they can be brought under control and associated together at the breeder's will.

SUMMARY.

1. The enriching and improving of the soil has been the dominant note in our system of wheat farming during the past generation.

2. There is reason to believe that as much attention might profitably be given to the improvement of the plant as there has hitherto been given to the improvement in its environment.

3. The primary aim of wheat improvement is the production of prolific varieties. Other important considerations are milling quality of grain, drought resistance, and rust resistance.

4. Extraordinary activity is being displayed throughout the world in wheat improvement.

5. Varieties may be improved by selection and cross-breeding.

6. Every care should be taken by farmers to get (*a*) the right variety of wheat, (*b*) well-developed seed, (*c*) seed from the most vigorous plants.

7. The common beet containing 6 to 7 per cent. of sugar has been developed into the sugar beet containing 20 to 25 per cent. of sugar by systematic selection.

8. Selection is based on variation.

9. Most variations are small, and diverge only slightly from the mean of the species. Others are large, and vary widely from the mean (mutations).

10. There are two general methods of selection (*a*) mass selection, (*b*) individual selection.

11. "Mass selection" has been effectively applied by farmers to the improvement of their crops. It must be continuous and uninterrupted.

12. "Individual selection" is more complicated, and requires elaborate records and trials for its successful application.

13. The introduction and acclimatization of certain foreign varieties is likely to lead to valuable direct and indirect results.

14. New varieties may also be obtained by cross-breeding.

15. The immediate effects of cross-breeding in wheats are (1) increase in vigour of progeny, (2) a "breaking of type."

16. Mendel showed that the variations induced by crossing follow definite laws.

17. Mendel's results have been generally confirmed by workers in widely different fields of inquiry.

18. The mode of inheritance of many unit characters in wheat have been worked out in detail.

19. The mode of inheritance of other characteristics in wheat of great practical importance has not yet been worked out.

20. The well informed wheat improver may enter on his task of wheat improvement without leaving much to chance.

(To be continued).

SOME VINTAGE CONSIDERATIONS.

F. de Castella, Government Viticulturist.

In view of the near approach of vintage it may be useful to briefly review the developments which have taken place within the last two years in connexion with the wine-making method described in the *Journal of Agriculture* for January, 1911, under the name of "Sulphiting," as well as with a few other points of interest to wine-makers at this time of year.

Such a review must be mainly confined to the newer wine-making developments; nevertheless passing reference to a couple of points, the importance of which has long been recognised, may here be permitted.

Temperature control has, it is gratifying to note, sufficiently established itself as an essential feature of the wine-making of Northern Victoria for further advocacy of it to be superfluous. In Southern Europe 95 deg. F. is looked upon as the critical fermentation temperature *which must not be exceeded if a sound wine is desired.* The higher gravity of our musts makes rapid and complete fermentation more difficult to realize; hence we may with advantage, fix our temperature limit a few degrees lower.

The correction of deficient acidity has not received nearly so much attention as the previous point. It is to be regretted that it is overlooked in too many of our cellars; hence it is well to once more call attention to the powerful influence for good exercised by an adequate proportion of fixed acid in the fermenting must. It is true that sulphiting is capable of replacing acid correction to a considerable extent—in the case of the soft, full-bodied wines required from us in London, this is a feature of sulphiting which is strongly in its favour—nevertheless it is well to remember that should the acidity of the must fall below, say, 6 per thousand of tartaric acid (an exact limit cannot be arbitrarily fixed), fermentation troubles may be expected, and it will be well to increase the acidity, either by direct addition of tartaric acid, or by blending in a sufficient proportion of more acid grapes.

Concerning pure yeasts, there is little to add to what was written on the subject in this journal two years ago, unless it be that their use continues to make headway in Europe, and that increased attention to the question in Victoria would, undoubtedly, prove to the advantage of our wine industry.

Sulphiting.

Since the date of the article on this subject, referred to above, the method has been even more extensively applied in Europe: as *Ventre* wrote recently*:—"To-day the process known under the name of Sulphiting tends to become general, and one can, without much risk, foresee the day when there will not be a single litre of ordinary wine made in France which has not been sulphited." It has also been extensively practised in Australia, with very generally satisfactory results during the past two vintages.

Though there is, perhaps, not much to be added to what was written concerning this new wine-making method two years ago, a few points may, with advantage, be more emphatically stated, especially since some misconception appears to have arisen in the minds of certain practical wine-makers in connexion with one or other of them.

Early Sulphiting Essential.

In conversation with some practical wine-makers, the writer has found that sulphiting has been looked upon by them as a substitute for temperature control, the bisulphite of potash being only added when the contents of the vat had become undesirably hot. If applied in this way the best results cannot be expected from the process. No doubt, temperature control is assisted, owing to the delay in the start of fermentation, as well as to restraint in its early stages; but it is in the selective action of the SO_2 on ferment organisms that the main benefits are to be looked for, and unless it be added from the very moment the grapes are crushed this cannot be depended upon. In other words, the SO_2 must be present in the crushed grapes before the incubation of the latent forms of the various detrimental ferments can take place. Gimel goes so far as to consider it advisable to dissolve the bisulphite before adding it. In his opinion, the delay which must occur before it can be dissolved would permit an undesirable development of injurious organisms. This objection might, no doubt, apply if the addition of the bisulphite were delayed until the vat was filled. It can be obviated by adding the necessary dose for the whole vat progressively, in small portions at a time from the start of the crushing of the grapes. The solution of the bisulphite and its even distribution through the crushed mass must be ensured by frequent stirring or occasional pumping of the juice from the bottom of the vat and its distribution over the mass. Sulphiting, no doubt, assists in temperature control, and has recently been described as "chemical cooling by retardation of the rate of fermentation,"† its action in this direction is quite insufficient in warm weather when loss of heat by natural causes (radiation and conductivity) is slight. Sulphiting cannot thus replace cooling. A serious objection to late additions of SO_2 is that they tend to interfere with the last stages of fermentation, thus making it more difficult for high gravity musts to ferment out dry. With early addition, on the other hand, this objection does not apply. Wines sulphited early are not only sounder, but also drier than those made according to older methods.

* *Progres Agricole*, 18th August, 1912.

† Recent developments in wine making methods—de Castella and Wilkinson—Australasian Association for Advancement of Science, Melbourne, 1913.

Different Forms of SO_2 and Dose to be Used.

The forms previously recommended are still those in vogue, namely, gaseous SO_2, bisulphite of potash, liquified sulphur dioxide, commercial sulphurous acid (SO_2 dissolved in water) and sulpho-phosphate of ammonia. In addition to this last proprietary compound, others of somewhat similar nature have been placed on the market in France recently. One in particular, known as "bio-sulfite," consisting of a solution of glycero-phosphate of ammonia in sulphurous acid, is rather highly spoken of. Gaseous sulphurous acid, resulting from the combustion of sulphur, need scarcely be mentioned here owing to the difficulty of regulating the dose. In France, though bisulphite of potash is still very largely used, liquified sulphur dioxide is tending to displace it, since it is cheaper and equally convenient, now that ingenious measuring devices are obtainable. These, however, have not yet found their way to Australia, and for the present it will be well to use bisulphite of potash. The standard dose is still the same as what was previously mentioned, viz., 3 to 4¼ oz. per 100 gallons of wine expected.

Bisulphite of potash,* containing as it does about half its weight of potash, necessarily neutralizes some of the tartaric acid of the grape. It is true that *Ventre* considers this slight loss of tartaric acid to be more than made up for in other directions, chiefly the protection from destruction of several other acids. Nevertheless, seeing the general deficiency of tartaric acid in Australian grapes, it is logical to add at least a sufficiency of tartaric acid to neutralize the potash of the bisulphite. This is theoretically 79 per cent. of the weight of bisulphite added. Wine-makers will, however, find it more simple to add an equal weight of tartaric acid to that of bisulphite employed. French legislation limits the quantity of bisulphite, which may be used, to 3 oz. per 100 gallons (20 grammes per hecto-litre), though there is no limit to the dose of sulphur-dioxide.

Need for Aeration.

As has already been pointed out in the article on Sulphiting referred to, aeration during fermentation is necessary in order to obviate the danger of formation of hydrogen sulphide, traces of which communicate a characteristic disagreeable taste to the wine. Such an accident, due to the reducing action of the yeast on the sulphurous acid, though of rare occurrence, has sometimes happened in Victorian cellars during the past two years since sulphiting has been largely practised. It can be entirely obviated by occasional aeration, especially during the early stages of fermentation. The mechanically driven pumps so extensively used in Northern Victorian wineries, during the vatting of red wines, provide ample aeration. If these are not employed, the fermenting mass must be aerated in some other way—more especially in the case of white wine, which is fermented apart from the skins, must careful attention be paid to this point.

* The salt known as bisulphite of potash and also as meta-bisulphite of potash is in reality a pyro-sulphite, the formula of which is $K_2S_2O_5$. Theoretically it contains 57.6 per cent. of SO_2, but owing to oxidation and formation of sulphate of potash at the expense of the sulphurous acid, it generally contains between 50 and 52 per cent. of SO_2.

A simple and efficient aerating appliance can be easily improvised at the cost of a few shillings by any vine-grower. The only apparatus required is a bicycle or motor pump (foot type preferred), a copper tube sufficiently long to reach to the bottom of the vat, terminated at the lower end by a rose perforated with small holes to divide the air bubbles, and a piece of flexible rubber hose to connect the two. The air may with advantage be sterilized by pumping it through a cotton wool filter consisting of a tin tube of 2 or 3 inches in diameter, and 12 inches long, with fittings to connect with the rubber hose on each end. With such an appliance (with or without filter) air can easily be blown through the fermenting mass. In the case of red grapes, the copper tube should be inserted in turn in different parts of the vat so that the aeration may reach all parts of it. In the case of white wine it is only necessary to stir the tube about while the air is being pumped through. Ten minutes aeration applied in this way to each vat, twice a day for the first four or five days of fermentation, will absolutely prevent any taste of sulphuretted hydrogen.

Settling or "Debourbage."

This method of making white wine, which has been fully described in the translation of *Roos'* "Wine-making in Hot Climates," page 169, is strongly recommended. Briefly described, it consists in allowing the sulphited must to settle for a few hours before the commencement of fermentation, the check given by the sulphurous acid enabling this to be done. The almost clear must is separated both from sediment and from surface scum, by racking through a tap situated about 8 inches above the bottom of the settling vat, into another vat where fermentation is allowed to proceed. Four and a half ounces of bisulphite of potash to the 100 gallons will check fermentation sufficiently to allow the settling method to be carried out.

Vinerie System.

This wine-making method, which promises great extension in France and especially in Algeria, must be briefly referred to here. It is the direct outcome of sulphiting, and consists in sterilizing the crushed grapes before any fermentation has been able to develop, with a heavy dose of sulphurous acid, usually 1 per 1,000 of the weight of the crushed grapes or must; in other words, six to ten times as much as is used in ordinary sulphiting. The sterilized grapes may then be stored until such time as they may be conveniently fermented. In hot climates the advantage thus presented of postponing fermentation until such times as temperatures are favorable is obvious.

When fermentation is decided upon, SO_2 is removed by the process known as desulphiting, carried out in partial vacuum and at a temperature of about 155 degs. Fahr., in a column working on much the same principle as the rectifying column of a still. Though full details cannot here be given, it is evident that slight modifications of this method could, with advantage, be applied by our northern growers. In the case, for example of exceptionally hot weather,

the grapes then picked might be prevented from fermentation by means of a treble does of bisulphite, until conditions became more favorable, when blending with twice the weight of fresh grapes would reduce the dose to a normal one, and enable fermentation to proceed.

Likewise, in the case of grapes carted from a distance, these could be crushed and sterilized with a heavy dose of bisulphite which would be subsequently reduced by "blending in" fresh grapes in sufficient quantity for fermentation to take place. The possibilities in such directions are obvious, and it is hoped that these few points may prove of service during the coming vintage.

PHOSPHATE OF AMMONIA.

The stimulation of yeasts by the use of small quantities of phosphate of ammonia was dealt with at some length in an article which appeared in this journal.* Since then, the process has been fairly extensively used in Northern Victoria, often with excellent results, though not invariably so. The most general cause of disappointment has been the too tardy addition of the stimulant. Some winemakers have only added it so late that the yeast had lost its vitality to such an extent that it could no longer respond to stimulation.

Several French authors go so far as to recommend its addition at the commencement of fermentation, hence the invention of such substances as the sulpho-phosphate and bio-sulphate already referred to. It is, however, to be feared that in warm climates such as this, such early addition would unduly stimulate the first start of fermentation and accentuate temperature troubles. It would appear more logical to add the phosphate of ammonia when racking the vat, should appearances lead one to anticipate deficient attenuation,† to use a brewing term. If not needed, in order to ensure the wine fermenting out dry, the phosphate is not only unnecessary, but undesirable; an excess of it might even serve as a food for other organisms than yeast. If, however, it be added whilst fermentation is still active, and in moderate quantity it is entirely eliminated, being consumed by the yeast plant. *Astruc* has proved that heavy applications are undoubtedly undesirable; but if used at the rate of from 1½ to 4¼ ozs. per 100 gallons, no such results are to be feared.

There are several phosphates of ammonia; the two most common being bi-basic and mono-basic phosphate. The former contains 53.78 per cent. of phosphoric acid and 25.75 per cent. of ammonia. The latter contains 61.72 per cent. of phosphoric acid, and 14.78 of ammonia. The yeast plant requires two and a half times as much nitrogen as phosphoric acid, so that even the bi-basic phosphate supplies too much phosphoric acid, and not enough ammonia. The excess of phosphoric acid appears, however, to be of little consequence, and the last-named salt is the one to which preference should be given.

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* *Journal of the Department of Agriculture for Victoria*, April, 1909.

† By attenuation is understood the reduction in gravity, owing to disappearance of sugar; or, in common cellar language, the degree of dryness attained.

Tannin.

The use of tannin is not so general in Australian wine-making as in that of most European countries. It is often used, no doubt, in our cellars in the after-treatment of wine, but it is to its value during the making of the wine that attention must here be drawn.

Though usually present in abundance in our red wines, it is frequently deficient in our white wines, and it is in the making of these that its more extensive use is recommended.

Tannin, as is well known, precipitates various substances, such as albuminous matter, the elimination of which improves the wine, especially as regards its power of maintaining good, bright condition afterwards. It also has a restraining influence on the development of several injurious micro-organisms.

Many of our practical growers have acquired the habit of allowing fermentation of white wines to commence on the skins. No doubt, soundness is ensured and tannin poverty corrected, but at the expense of the colour and delicacy of the resulting wine. Far superior dry white wines will always be made by immediate pressing and fermentation entirely apart from the skins. In Europe sufficiency of tannin is ensured by energetic pressing such as is not usually practised in Australia, the marc being forked at least once and "cut" a couple of times, before it leaves the press. A similar result is secured by the artificial addition of tannin which is expressly permitted by our pure wine legislation. The addition of ¾ oz. to 1 oz. of tannin per 100 gallons of must will greatly improve the condition of the resulting wine. Some authorities recommend that the addition be only made after the first rush of the fermentation is over in order to avoid loss through absorption by yeast. Others prefer to add it from the start. If settling (*debourbage*) be practised, it is well to follow the latter course, the settling being more rapid and thorough owing to the precipitation of albuminous substances.

In the case of faulty grapes, damaged by moulds, insect pests, &c., the dose of tannin can with advantage be doubled, and 1½ and even 2 ozs. per 100 gallons of must may be added. In this case early addition is certainly to be preferred.

Tannin may be added directly to the must, but, owing to it being rather difficult to mix, it is preferable to first dissolve it in a little weak spirit.

ANNUAL GRANT TO AGRICULTURAL SOCIETIES.

SUBSIDY CONDITIONS FOR 1913.

CONDITION A.—COMPULSORY.

The awards of prizes in all classes for stallions three years old and over at the Society's Show must be subject to the possession by the exhibit of a Government certificate of soundness.

Stallion Inspection Parades will be held at different centres throughout the State prior to the commencement of the Show season (Time Table of Stallion Parades for 1913 will be available shortly after 1st April, 1913). The parade centres are so arranged that all owners of Show stallions have the opportunity of submitting them for examination for the Government Certificate of Soundness before the closing of entries for the Show. Show Secretaries will require to obtain evidence of the possession of the Government Certificate in respect of exhibits at the time of entry, and should not accept entries of other than certificated horses.

Immediately after the Show, Secretaries of Societies are required to forward the names *of all the horses* that have won the prizes in stallion classes, together with the names of the owners, to the Director of Agriculture.

CONDITION B.—OPTIONAL

Agricultural Classes.

A sum of £10 as a special subsidy will be added to the *pro ratâ* grant to such Societies as carry out agricultural classes in strict conformity with the following conditions and to the satisfaction of the Department:—

Applications must be submitted not later than 15th March, 1913.

Thirty students at least must be enrolled before a class can be held.

The rent of hall and all local charges are to be paid by the Agricultural Society; all other expenses by the Department. Arrangements must be made to insure the uninterrupted use of the hall during the time the lectures are going on.

A roll of attendances at lectures and demonstrations shall be kept.

The agricultural classes will extend over two weeks, five days a week, a demonstration being given each morning and afternoon, and four limelight lectures on evenings to be arranged for by the Secretary of each Society.

At the conclusion of each class, a written examination of about 1½ hours duration will be held, a medal to be awarded by the Department to the student in each district obtaining the highest number of marks for examination work and regular attendance combined. Two-thirds of the maximum marks obtainable will be given for examination work, and one-third for regular attendance. The Department reserves the right to withdraw the offer of the medals in the event of there being less than five students remaining for examination. Students in attendance at Agricultural High Schools and Colleges, or at the Continuation Schools, and teachers from such institutions or State Schools shall not be allowed to sit for such examination.

A special examination for the Gold Medal offered by the Australian Natives' Association will be held at the close of the year, and only winners of Departmental medals will be eligible to compete thereat.

Subjects of First Week.

Agriculture.
Live Stock and Veterinary Science.

Subjects of Second Week.

Two or more of the following, to be selected :—(*a*) Sheep Breeding and Management (including Wool Classing and Lambs for Export); (*b*) Dairy Farming (including Management and Breeding of Pigs); (*c*) Poultry Breeding and Management; (*d*) Orchard and Garden Work.

Condition C—optional.

LECTURES.

A sum of £5 as a special subsidy will be added to the *pro ratâ* grant to such Societies as arrange for and carry out a series of four lectures throughout the year in strict conformity with the following conditions and to the satisfaction of the Department :—

Applications must be submitted not later than 15th March, 1913, and accompanying the application must be a list of the subjects (see below) which the Society chooses for the series. The dates of lectures will then be fixed by the Department, and if Societies will state the most suitable seasons for their districts the lectures will, as far as possible, be arranged accordingly.

An attendance of at least fifteen *bonâ fide* farmers, farmers' sons or farm-hands will be required, otherwise the lecture will not count for the special subsidy. In case of failure to secure such attendance another lecture will not be substituted, nor will any subsequent lectures that may have been arranged be given.

The President or Secretary or a member of the Council or Committee of the Society must take the chair at each lecture and must certify as to the number and *bona fides* of the attendance as above required.

The rent of the hall, advertising and all other local charges are to be paid by the Agricultural Society; all other expenses by the Department.

The Department will recognise any suitable lecture, paper, or address that a Society may arrange to have delivered by any person other than a Departmental officer, and such lecture will count as one of the four required, provided due notification prior to delivery of lecture is given, and the President of the Society afterwards certifies as to *bona fides* and suitability of the lecture and the number and character of the attendance.

SYNOPSIS OF LECTURES AND DEMONSTRATIONS.

PRINCIPLES OF AGRICULTURE.

1. The plant food of the soil.
2. Cultivation methods and management.
3. Principles of manuring.
4. Valuation of artificial manures.
5. The management of the farm.
6. Special crops and catch crops.
7. Irrigation principles and methods.

VETERINARY SCIENCE AND LIVE STOCK SUBJECTS.

1. The structure and care of the horse's foot (lantern).
2. Brood mares and breeding mishaps (lantern).
3. Colic, constipation, and other bowel complaints.
4. Ailments of dairy cows—milk fever, impaction, udder complaints.
5. Contagious diseases of stock—abortion, blackleg, tuberculosis, anthrax, pleuro pneumonia, &c. (lantern.)
6. Ailments of swine, or ailments of sheep.
7. Unsoundness in horses (lantern).
8. Principles of stock breeding—stud horses (lantern).

DAIRY FARMING.

1. Breeding and management.
2. Dairy buildings.
3. Dairy management.
4. Milk and cream testing.
5. Foods and feeding.
6. Pig breeding, feeding, and management.

POULTRY BREEDING AND MANAGEMENT.

1. The poultry industry: its importance. Locality—suitability or otherwise.
2. Housing (construction of, materials, insect proof, aspect, &c.). How to select stock.
3. Breeds: payable or otherwise, eggs and table. Breeds adapted for export—modes of crossing.
4. Turkeys: their care and management. Chicken raising and care.
5. Foods and feeding demonstrated.
6. Common ailments of poultry. Incubation—natural and artificial.

ORCHARD AND GARDEN WORK.

1. Fruit growing—Varieties suitable to the different localities, soils and sites.
2. Preparation of land—Planting and pruning.
3. Cultivation Manuring and management.
4. Insect pests and fungus diseases and their treatment

VITICULTURE.

1. Establishment of Vineyard.
2. Phylloxera and resistant stocks—Preparation of land.
3. Propagation and grafting—Best varieties to grow
4. Pruning and seasonable operations.
5. Wine-making and cellar management.
6. Drying raisins, sultanas and currants—Packing fresh grapes for export.
7. Vine diseases and treatment.

POTATO CULTURE.

1. The soil and its cultivation—Care of the growing crop, manures.
2. Seed and its selection—Keeping of seed potatoes.
3. Diseases and their treatment.

SUBJECTS AND STAFF.

Principles of Agriculture—Mr. A. E. V. Richardson, M.A., B.Sc.; Dr. J. W. Paterson, Ph.D., B.Sc.; and Mr. Temple Smith.

Veterinary Science, Stock Management, Dairy Sanitation and Education—Messrs. Robertson, B. V.Sc.; Kendall, B. V.Sc.; Griffin, M.R.C.V.S.; Cother, G.M.V.C.; Johnstone, B. V.Sc.; and Heslop, L. V.Sc.

Dairy Farming—Mr. R. T. Archer and staff of Dairy Supervisors.

The Dairying Industry and Export Trade—Messrs. Crowe and Carroll.

Orchard and Garden Work—Messrs. Carmody, Davey, and Pescott.

Sheep Breeding and Management—

Viticulture—Mr. F. de Castella.

Flax Culture and Demonstrations at Shows—Mr. Robilliard.

Poultry Breeding and Management—Mr. H. V. Hawkins.

Poultry Dressing Demonstrations—Mr. A. Hart.

Potato Culture—Mr. G. Seymour.

Tobacco Culture—Mr. Temple Smith.

Pig Breeding and Management—Mr. R. T. Archer.

Fruit Industries—Mr. J. G. Turner and staff.

Insect Pests—Mr. C. French. Junr.

Plant Diseases—Mr. W. Laidlaw, B.Sc., and Mr. C. C. Brittlebank.

Irrigation—Expert of State Rivers and Water Supply Commission.

Apiculture—Mr. F. R. Beuhne.

HUMUS IN THE WHEAT AREAS—

Speaking at the Twenty-fourth Annual Congress of the Agricultural Bureau of South Australia, Professor Lowrie said: "It used to be argued that if plenty of phosphates were put on the land, such a wealth of herbage would result that the organic matter or humus would be kept up. That, however, has not proved to be the case with the man who fallows clean. When the crop is cut for hay the question of supplying humus is not a difficult one. The stubble can be ploughed and worked down, and a crop sown for feed. It may be barley, oats, rape and mustard, peas, and in some districts Italian rye grass. If the tractors which are being introduced will enable the farmer to plough, work up, and prepare for sowing about 15 or 20 acres a day, they are the implements which South Australian conditions require. These would enable the farmers to go over the stubbles at the same time that the teams are sowing the fallows. If the fallowing is done too late there is not the addition of organic matter to the soil. Rape can be sown at the rate of 3 to 5 lbs. per acre, with 2 or 3 lbs. of mustard. If they are sown on stubble the land should be worked and manured well. For fattening lambs I find mustard with rape will avoid risk of deaths. In districts with a good rainfall Italian rye grass and peas should certainly be tried." Where the crop is stripped instead of cut for hay, the problem of growing sheep feed is admittedly difficult unless the stubble is first burnt off.

WHEAT GORGE IN HORSES.

By R. N. Johnstone, B. V.Sc. (Veterinary Staff).

In those parts of the State where wheat is grown farmers frequently experience at harvest time a considerable amount of trouble and loss due to horses gaining access to wheat and gorging themselves. The result is usually an attack of wheat colic or gripes which often ends fatally, or brings on an attack of laminitis or founder, which, so far as the farmer is concerned, is frequently as bad as, if not worse, than the death of the animal. The horses affected are generally valuable working draughts, and the trouble occurs when they can least be spared from work on the farm. Access to wheat is, as a rule, accidental, a gate is inadvertently left open, or a fence is broken down, and usually more than one horse is affected. The symptoms vary according to (1) the amount of wheat eaten, (2) the presence or absence of other food in the stomach, (3) the breed and temperament of the animal affected. Sometimes symptoms are very slight, the horse looks dull and uneasy, is "off his feed," and has occasional slight attacks of pain, causing him to stamp his feet, or kick at his abdomen. In other cases, the colicky symptoms are much more pronounced, the horse is extremely restless, lies down, rolls, gets up again, and walks around as if in intense pain. This may go from bad to worse, the animal may throw itself down violently, roll over and over, jump up, whirl about, drop down again, paw, or strike with the front feet, steam and sweat, and be so violent that it is dangerous to approach close enough to render aid, the breathing is laboured, the membrane of the eyes, nostrils, and mouth assume a yellow colour, and frequently the animal sits up on his haunches like a dog. In some cases the animal attempts to vomit as shown when the upper lip is turned up, and the head is drawn in to the chest arching the neck, or is held outwards and downwards, stretching the neck to its full extent, the throat moves, and the flank heaves violently. Gas may then escape from the nostrils, followed sometimes by a sour smelling froth, and occasionally by stomach contents. Owing to the position and construction of the stomach the horse cannot vomit except when the stomach is so full that its walls become violently stretched, and if the accumulation of food or gas is sufficient to stretch the stomach so that vomiting is possible it may be great enough to rupture that organ. When this occurs colicky pains as a rule cease suddenly, the animal remains quiet, trembles all over, the face has a haggard expression, and death soon ends the scene. For some time, practising veterinary surgeons and others held varying ideas about the treatment of these cases, some declaring that if the animal got a drink of water after overfeeding on wheat, the result was invariably fatal, the reason given being that water swelled the wheat in the stomach, and caused rupture of that organ, while others declared that water was beneficial in these cases, that if the animal would not drink water it should be forcibly administered in large quantities. A horse secretes and swallows about six gallons of

saliva daily, and this, together with the digestive juices met with in the stomach, will swell the grain to its utmost extent. Water when swallowed by a horse does not all remain in the stomach, the greater quantity of it passes directly on to the cæcum or water gut. If taken immediately after the grain has been eaten water will practically wash some of the undigested grain out of the stomach, and so relieve the pressure in that organ. Experiments carried out by Dr. W. T. Kendall at the Veterinary Research Institute have proved that in the majority of cases death is due to a poison which is formed by the wheat while in the stomach of the horse. It has been found that this poison is formed only in the presence of the acid digestive juices of the stomach, and that if some alkaline substance—such as bicarbonate of soda (baking soda)—is administered, thus rendering the stomach contents alkaline, formation of the poison ceases. Therefore, the most advisable treatment is to administer bicarbonate of soda in large doses, about 4 ounces in a quart of water as a drench, or if the animal is thirsty and will drink from a stable bucket, add the soda to a gallon of water. This prevents the formation of poison for a time, but it also stimulates the secretion of the acid digestive juices so that in time the contents of the stomach will again become acid, and the formation of poison will proceed as before. Therefore it is necessary that the wheat should be removed from the stomach as soon as possible. That can be encouraged by a liberal supply of water. Purgatives, such as aloes or linseed oil, take so long to bring about purgation in the horse that in most cases they are useless, and as they also nauseate the animal, and tend to bring about attempts at vomiting, thus increasing the danger of rupture of the stomach, they are to be avoided. The man who is not within reach of a veterinarian must administer another dose of bicarbonate of soda if the colicky symptoms return. Water is beneficial in all cases, as it dilutes the poison and washes it out of the stomach, so the animal should be allowed as much water as it will drink with bicarbonate of soda added. While many animals will recover without treatment of any kind, it is not advisable to postpone treatment until dangerous symptoms set in. On the other hand, excessive administration of drugs should be avoided. Many owners are too ready to pour all sorts of drugs down a horse's throat, and frequently do more harm than good. All food should be withheld until colicky symptoms cease, and for the next few days light, easily digested food such as bran mashes and green fodder, if obtainable, should be given. The horse should not be returned to work too early. An overfeed of wheat frequently gives rise to an attack of laminitis (*founder*) the nature and treatment of which affection will be dealt with in a subsequent article.

MANURES AND MANURES ACTS.

By Will. C. Robertson, Agricultural Chemist's Staff.

During the years 1904-11 the number of farmers using artificial fertilizers in Victoria increased from 20.167 in 1904 to 27,845 in 1911 an increase of 33.1 per cent.

Forty-five thousand nine hundred and forty tons of artificial manures were sown on 1,521,946 acres in 1904, whilst 86,316 tons were placed on 2,714,854 acres in 1910-11.*

These figures give an increase of 87.9 per cent. in manures consumed over a period of six years.

An approximate valuation of the artificial fertilizers purchased by the farmer in 1911 amounts to £350,000—this fact in itself is sufficient to justify the small outlay involved in the system of inspection adopted by the Chemist for Agriculture in Victoria.

Incidentally it might be remarked that this expenditure does not amount to 1d. per ton of artificial manure consumed.

In certain countries the manufacturers of artificial fertilizers are taxed, to the extent of one or two pence per ton of manure produced, to defray the cost of inspection and analyses, but in Victoria no such tax exists.

Artificial manures, especially of late years, have played an important part in Victoria's annual production, and are destined to become still more prominent in the future.

This paper deals mainly with the inspection of artificial manures in the State of Victoria during the past twelve months, together with a general review of the past eight years' work.

Although the great importance of artificial manures is readily admitted by the farming community, the surprising fact remains that a large percentage of Victorian farmers are very hazy in their knowledge of the composition and functions of the various manures on the market.

The Victorian farmer labours under sufficient disadvantages without adding another to the list. The price of land is on the upgrade, wages on the increase, machinery dearer, and, last but not least, the price of artificial fertilizers has an upward tendency.

In the latter respect the following "Graphs" will be of interest:—

No. 1 depicts the rise in the price of the nitrogen unit (*i.e.*, 1 per cent. of nitrogen) during the years 1905-1913 inclusive.

The figures on the sides of the diagram denote pence. It will be noted that the potash unit has remained fairly constant, but a unit value has been plotted this year for the potash in potassium nitrate, and this figure shows a remarkable increase.†

The nitrogen figures are particularly interesting—the units of all forms are considerably higher, and that for dried blood shows an increase from 11s. in 1905 to 15s. 9d. in 1913.

A rise in nitrogen values has been prophesied for many years past, but when the theory of "fixing" the nitrogen of the atmosphere

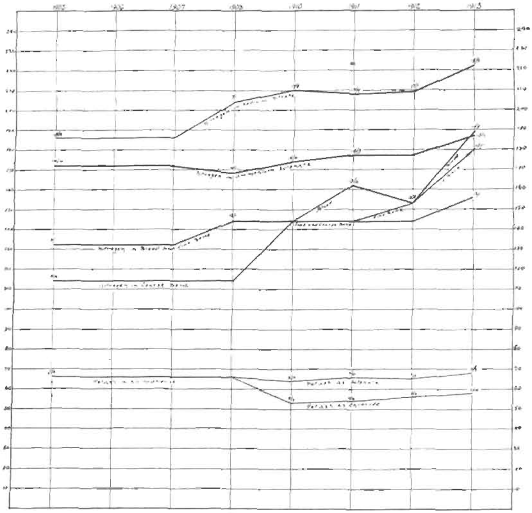
* Statistical Register of State of Victoria, 1910.

† See *Journal of Agriculture*, Victoria, 1913, p. 18

terminated in fact, and calcium cyanamide and nitrate made their advent, the fear was to an extent dispelled.

However, as the values for nitrogen show a marked increase in the face of the artificial fixation of the nitrogen in the atmosphere, and the utilization of the compounds so produced, the policy of nitrogen conservation on the farm requires more than passing attention.

Graph No. 2 sets out, firstly, the number of pounds of phosphoric acid and nitrogen received by the farmer for every twenty shillings spent in the purchase of bonedust during the years 1906-13, and,



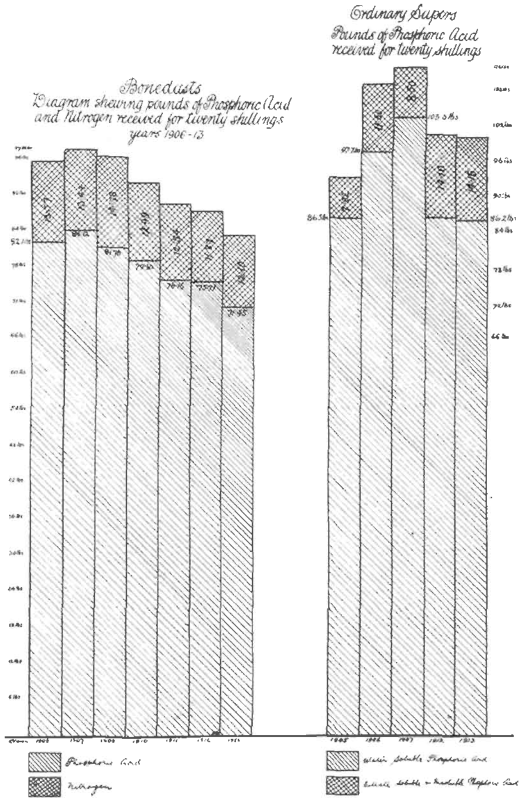
Graph 1.

Showing the rise in the price of the nitrogen unit (*i.e.*, 1 per cent. of nitrogen) during years 1905-13 inclusive.

secondly, the number of pounds of water soluble phosphoric acid, and other forms obtained for twenty shillings when purchasing superphosphate in the years 1905-06-07-12-13.

As explained by the key at the foot of the graph, the " one-way " shading in the case of bonedusts denotes pounds of phosphoric acid—the figure being given at the top of each column. The cross shading denotes pounds of nitrogen, the correct figure for which is placed in the shading.

The figures on the side are the scale of pounds, whilst the figures at the foot show the year.



GRAPH 2.

(1) Shewing the number of pounds of phosphoric acid and nitrogen received by the farmer for every 20/- spent in the purchase of bone dust during years 1906/13.

(2) Number of pounds of water soluble phosphoric acid, and other forms obtained for 20/- when purchasing super-phosphate in the years 1905, 1906, 1907, 1912, 1913.

In the case of ordinary supers. (right-handed diagram), the "one-way" shading stands for pounds of water soluble phosphoric acid—the other forms being denoted by the cross shading on the top of the column.

Since the year 1907 there has been a gradual decline in the average composition of bonedusts, together with an increase in the price per ton.

To put this in a nutshell, a ton of bonedust which cost the farmer £5 8s. 3d. in 1906 is costing him £6 3s. in 1913—an increase in price of 13.60 per cent.

Referring to the other side of the "Graph," it will be noted that "other forms" of phosphoric acid show a marked increase in the composition of ordinary "supers," and this at the expense of the more *valuable water soluble material.* This is solely due to the admixture of insoluble rock phosphate, which serves the double purpose of acting as a "drier," and building up the content of total phosphoric acid, so as to minimize the decrease in the water soluble content.

During the years 1906-07, the appearance of a new firm on the scene of operations, and the resulting competition, sent up the quality of "supers," and caused a fall in price. Unfortunately for the farmer, this state of affairs soon balanced, and to-day he pays approxi*mately the same price for his superphosphate as he did in 1905.*

The following table sets out the prices of the various artificial manures at Home and abroad.

The prices marked *with an asterisk are taken from Fertilizers,* August, September, October, 1912, and although they may be wholesale prices, the fact cannot be disguised that the local farmer pays a *much higher rate for his fertilizers than does his friend across the* sea.

Prices at Home and Abroad.

Manure.	Price per ton abroad.	Price per ton in Victoria.
Superphosphate ..	£3* per ton on rail (16 % water sol. phos. acid)	£4 7s. 6d. per ton on rail (17 % water sol. phos. acid)
Thomas' Phosphate ..	£2 12 6*	£4 4 6
Rock Phosphate (80 %) ..	£2 16 6*	£5 0 0
Sodium Nitrate ..	£12 0 0*	£13 10 0
Ammonium Sulphate	£14 15 0*	£15 0 0
Bonedust	£6 0 0*	£5 19 7
Kainit	£2 10 0*	£5 0 0
Potash Sulphate ..	£10 11 0*	£14 7 6
Potash Chloride ..	£9 10 0*	£14 5 0

It should be noted that the superphosphate quote is for a 16 per cent. article, whereas the standard sold in Victoria is 17 per cent. This, however, is only a matter of a few shillings per ton.

The producer has to sell his wheat, etc., in the world's markets, *and therefore is not empowered to increase his prices*—the average price in Victoria for wool, wheat, oats, and live stock (excepting horses) for the last five years shows no appreciable difference. It, therefore, behoves the farmer *to learn as much as possible of the high-*

priced aids he is dependent upon, so that he may carefully peruse the registered list of the various brands of manure* and intelligently select the brand of the one required, giving him the best and most for his money.

The unit values for the various forms of nitrogen, phosphoric acid, and potash are published annually in the *Agricultural Journal* by the Chemist for Agriculture, together with the method of valuing any manure on its guaranteed analysis.

Manures Acts Inspection.

Under the heading of "A few Disgraceful Cases of Fraud," Dr. F. J. Howell writes, in the *Agricultural Journal*, page 376, 1903-4—"Although, generally speaking, the samples sent in through the Agricultural Societies were of a high standard, there were a few samples received direct from the farmers which were *practically worthless for manurial purposes*, and the conclusion must be drawn that, in a certain number of cases at any rate, the farmer in Victoria is being defrauded by unscrupulous vendors. The most flagrant cases of fraud occurred at Tarrawingee, where an article sold as a high grade superphosphate was found to contain only 2.60 per cent. cit. sol. and 3.91 insol. phos. acid."

The value of a manure of this description would be something under £1 per ton.

In 1904, the year following this report, Act No. 1930 was placed on the statute-book, and inspection took place under this Act from 1904-10.

After careful study, the administration of this Act was found to be cumbersome and to have many disadvantages. In 1910, certain sections were repealed, and an amending Act drafted (Act No 2274), and passed by Parliament. At the present time the work of inspection and prosecuting, together with the analyses attached thereto, is conducted under the two Manures Acts, viz., Nos. 1930 and 2274.

One important effect of the amended Act is a decrease in the number of samples collected during the year. This is brought about by a compulsory clause, rendering it imperative for the Chemist for Agriculture to forward the result of the analysis of any given sample to the manufacturer within thirty days. With a limited staff doing a variety of work only a small number of samples can be analyzed monthly.

The prosecutions have been many and varied.

The policy of the Department in the early stages of the administration of the Act was to tender advice and give warnings in all cases of non-compliance detected, thereby enabling the manufacturers and dealers to make themselves acquainted with the new conditions.

In 1907, two firms, who had previously received warning, were prosecuted for not labelling parcels of manure, and in two cases, where manufacturers would persist in selling manure without submitting a true sample to the Chemist for Agriculture, as required by the Act, proceedings were successfully instituted.

* *Journal of Agriculture*, Victoria, January, 1913, p. 18.

From the passing phases, these cases would be termed technical breaches, but in one case, at least, actual fraud was cleverly covered.

In 1908, one or two cases of adulteration made their appearance.

During the year 1909, owing to adulteration becoming prevalent, all violations, where manufacturers or dealers had received previous warning, were proceeded against.

The following table sets out the number of samples collected during the years 1906-12, together with the number of prosecutions and the amount of fines:—

Year.	Number of Samples Collected.	Number of Prosecutions.	Fines.
			£ s. d.
1906	147	Nil	Nil
1907	129	4	8 6 0
1908	175	2	4 2 0
1909	183	10	39 10 0
1910	131	7	7 10 0
1911	70	4	31 0 0
1912	68	13	28 0 0

During the years 1910-11, prosecutions took place against manufacturers and dealers, mostly under section 5, for not submitting invoice certificates with manure sold, or under section 7 for incorrect labelling.

In each year, however, *there was at least one very bad case of* adulteration.

During 1912, the season just finished, it is most unsatisfactory to *have to report adulteration to be still more prevalent.*

A glance at the following table, setting out the percentage of the samples collected during the years under review, which were found to be under guarantee and under the limit allowed by the Act, serve to illustrate:—

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	Per cent. of collected samples found to be adulterated.
[illegible]	Nil.
[illegible]	·57 per cent.
[illegible]	1·09 „
[illegible]	2·30 „
1911	5·70 „
1912	**10·30** „

In the worst case last year the difference in value between the guaranteed manure purchased and the adulterated article supplied amounted to 19s. 8d. per ton, and the marked increase of adulteration shown to exist probably owes its origin to the low penalties provided under the Act.

In the case cited above, the manufacturer has an annual output of approximately 3,000 tons, *and it was only a matter of supplying 30*

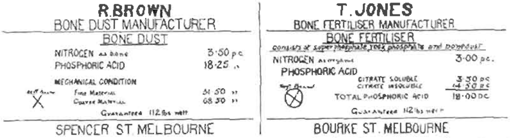
tons of the adulterated manure to cover all expenses, including fine and costs.

One manufacturer who was successfully proceeded against for selling manure under guarantee frankly admitted to the inspecting officer at the time of taking the sample that he had run short of manure, and, rather than disappoint a good customer, he made up the order by mixing with marl. Presumably he considered disappointing his customer a more heinous crime than selling him manure known to be inferior.

In another case, a farmer sent an order to an agent for "bone and super." The agent had none in stock, but, rather than refuse an order, and incidentally to "clean up," he mixed several "butts" (*i.e.*, bags of manure that had been opened) together and sent it off, happy and content, without a guarantee.

In the latter case the farmer may have received the best of the bargain, and yet he may not. At any rate, he bought "a pig in a *poke*."

All cases of adulteration during season 1912 were in the bonedust, *or bone fertilizer section*, and it may be reasonable to suppose that this is due to the scarcity of the genuine article—at the same time it must



be said that this is not a fair excuse, and the honest trader should refuse orders rather than run the risk of supplying a substitute.

Bonedust is a most difficult manure to obtain at the present moment, and time and again, during 1912, farmers were met in possession of the manure termed "bone fertilizer," but which they had bought for bonedust.

Always when instances of this nature have come under notice, the *attention of the farmer has been drawn to the labels attached to the* bags of manure, and the extraordinary explanation has been put forward that the Agricultural Department will *not* allow manufacturers to sell bonedust, they are compelled to sell "bone fertilizer." This is strictly incorrect.

During the year 1909, research analyses were conducted in the Laboratory on samples of bonedust(?) collected in various parts of the country. The result was the disclosure of the astounding fact that instead of being the product obtained by grinding bones, the majority of the bonedusts(?) on the market were mixed manures, containing very little bone, being principally mixtures of "super" rock phosphate, and meat refuse, or some other organic material supplying nitrogen.

Manufacturers were immediately informed that this mixture could not be sold as bonedust, and they decided to sell it under the name of "*bone fertilizer.*"

A "bone fertilizer" may be—anything; but a bonedust is defined under Act No. 2274 as "a manure consisting only of disintegrated bones, or recent animal matter, and containing over fifteen parts of phosphoric acid in each one hundred parts of the manure."

Bonedusts and bone fertilizers are labelled in a totally different manner, as a glance at the above exhibit will show:—

After perusing the following table, which gives the average composition of the bonedusts and bone fertilizers on the local market at the present moment, together with the price asked and the calculated value of the two articles, the farmer may draw his own conclusions.

Comparison between Bonedusts and Bone Fertilizers.

Manure.	Season.	Nitrogen.	Phos. Acid.	Price asked.	Cal. Value.
				£ s. d.	£ s. d.
Bonedust	1912–13	3·31	19·63	6 3 0	6 3 0
Bone Fertilizer ..	1912–13	3·65	16·51	6 1 0	5 2 9

Pure bonedust is becoming scarcer every year, yet there is not the slightest doubt but that a vast tonnage of bones is annually wasted in Victoria.

This will undoubtedly be the case until some system of co-operation on the part of farmers takes place, whereby bone mills are installed in country centres, the raw material being systematically collected around the countryside, and the finished product being sold to the shareholders in each manuring centre at cost price.

Such a scheme would serve the twofold purpose of saving and utilizing most valuable fertilizing material, and at the same time provide farmers with the genuine article.

Bones.

During the year 1910, there were slaughtered in Victoria 249,229 head of bullocks and cows, 70,436 head of calves, 4,245,881 head of sheep and lambs, and 257,287 head of pigs.*

The carcass of a bullock or cow will average approximately 90 lbs. of bones, that of a calf or sheep 10 lbs., whilst that of a pig gives 20 lbs.

Taking these averages, cattle slaughtered in Victoria during 1910 produced 10,328 tons of bones, the sheep and lambs give 18,955 tons, whilst pigs further augment the total by 229.7 tons—not taking into account the bones obtained from the carcasses of dead horses, we obtain a grand total of 29,512 tons of bones.

This tonnage is a fairly accurate estimation of the amount of bones produced during the year under review, and may be taken as a fairly exact estimate of the amount of bones that could be made available for the production of bonedust, and yet the thirty-odd bone mills working in the State placed approximately 7,000 tons at the disposal of the farmer.

* Statistical Register of State of Victoria, 1910.

This works out at 23.72 per cent., and the value of the bones wasted amounts to £135,000

It may be said that these figures are wrong, in that bones are utilized for other purposes, and, again, the householder does not waste the kitchen bones, but puts them on his vegetable garden.

The reply to the first argument is that the estimate of bones produced allows for the bones used for industrial purposes, whilst, in the second case, bones are wasted when thrown promiscuously on the soil, for they should be sown in the finely-divided condition; furthermore, the majority of kitchen bones are utilized under the copper on washing day, and the ash thrown in the poultry yard.

Review of Samples Collected, 1912.

Of the sixty-eight samples of artificial manure collected in various parts of Victoria during the past year, there were fifteen samples of bone fertilizers, fourteen samples of "bone and super," nine superphosphates, nine bonedusts, whilst the remaining twenty-one consisted of dissolved bones and super, dried blood, Thomas' phosphate, animal fertilizers, nitro-supers, guano, sodium nitrate, blood, bone and super, and mixed manures, such as potato, maize, rape, fodder, grass, and special grain.

The unsatisfactory condition of the bonedusts and bone fertilizers has already been discussed. The "bone and supers," whilst complying with the guarantee, contained samples which were not at all true to name, and in one instance it was very evident, from the casual glance, that the manure contained little or no bonedust, but consisted of *rock phosphate* and "*super.*"

Farmers would do well to buy bonedust and super separately, and mix the two themselves.

The analyses of the superphosphates collected proved them to be of very high standard, and viewing the manure trade from the superphosphate stand-point there is left little to be desired.

All the samples of the mixed manures, nitro-supers, dried blood, etc., analyzed well up to the guarantee, but the increase in the sale of mixed manures is rather hard to understand, for bold indeed is the scientist who will prescribe, say, a potato manure to exactly suit all soils in Victoria. If the farmer is to obtain any benefit from the small amount of potash or nitrogen, or both, as the case may be, that is contained in any given mixed manure, then it must of necessity be at the expense of a dressing of at least one ton per acre.

Consignments of "Star and super" are met with here and there, and inquiries elicits the information that this "basic" manure is giving good returns on some of the heavier soils.

The samples of "Star and super" collected analyzed well up to the guarantee, but as there is certain to be reversion in mixing star phosphate with superphosphate to produce the manure under discussion, a freshly mixed "star and super" will indubitably be of more value than one that has been mixed some months, or, may be, years.

Under the circumstances, where a farmer is tilling a soil of the type that responds to a dressing of this manure, it would be advisable to buy the two manures separately and mix them on the floor of the barn at the farm.

It is asserted that in no other part of the world is the inspection of artificial manures so stringent as in Victoria! If this be true, then one must look for a reason for the increase in adulteration.

As hereinbefore stated, this adulteration takes place in the bonedust and "bone fertilizer" section, but the driver of the 'bus sees more than the passenger inside, and there is not the slightest doubt but that the inspection of the artificial manures sold in Victoria will be just as vigorously carried out in the future as it has been in the past.

Providing the elements be kind to the Victorian farmer, and the manure he purchases is the genuine article, life is made easy—at least, his work is lucrative; but no matter how kind the elements are, if the manure he buys be rubbish, a good crop is by no means assured.

Under the circumstances one would think that the farmer would lend all the assistance in his power to help the Department, which has for one of its aims the supervision of the manure traffic, thereby rendering him safe, as far as the quality of the article he purchases and relies upon is concerned, and yet instances are common where the farmer actually stands in the way of the inspecting officer and his duties.

It would be a drastic action indeed if the farmer who had purchased manure was summoned for obstruction, and yet such a course could be, and may be, pursued in future.

To cite one instance of obstruction at the hands of the farmer. This took place last year, and happened over a bonedust transaction. The manufacturer was being proceeded against, and on a sale being traced, the purchaser (a farmer) was written to by the Department and asked for the invoice certificate or warranty obtained with the consignment of manure. The document was required by return post, and fully a month had elapsed from the date of delivery.

No reply was received until after a second letter had been written, and then an informal document was sent along. It subsequently transpired at Court that originally no warranty was received with the manure, but instead of the Department being made aware of the fact, the farmer obtained a guarantee from the manufacturer some time after he had used the manure, and forwarded this document to the Department. This farmer could have been prosecuted.

Farmers are requested to see for themselves that an invoice certificate is submitted at the time of sale, and in all cases to file these documents, in case they be required subsequently as evidence. By so doing they will greatly assist in the administration of the Artificial Manures Acts.

Potatoes are surface feeders, and to ensure an abundant crop liberal manuring is required. A general manure supplying nitrogen, phosphoric acid, and potash will often pay best.

The roots and stubble left by a cereal crop are considerable in amount but poor in nitrogen. The root residues from leguminous crops, clover, vetches, and lucerne are very rich in nitrogen, and form an excellent preparation for a cereal crop.

FARM COMPETITIONS—NHILL, 1912.

By Temple A. J. Smith.

The results of the Nhill Farm Competitions herewith, and opportunity is taken of congratulating the Nhill Agricultural and Pastoral Society on the fact that in this, the twelfth year since the inauguration of the system, the entries total thirty-four, which is, I believe, a record for the whole period, proving that the interest is well sustained, and the system a useful one for various reasons. It is also a high tribute to the energy of the Secretary, who has evidently been unsparing in his efforts to make a success of the undertaking.

The old saying "that competition is the soul of business" evidently applies to farming in this case, and the spirit of emulation induced has in the past, as it must in the future, lead to progressive methods in all branches of the industry. The object lesson set by some of the leading farmers of the district is a valuable one to others, and the opportunity offered so open-heartedly of inspection and discussion on the actual farms themselves must lead to better practices, and, incidentally, better monetary returns, in a district so full of great resources and possibilities.

It is gratifying to find that there are men like Messrs. Dahlenburg, G. and W. Batson, G. Crouch, and others, experimenting in wheats and grasses with a view to the improvement of yields and quality, and, though much of this work is discouraging, some good results have already been achieved, as, for instance, Mr. F. Schultz, who has a fine crop of Viking wheat, asserts that he prefers this variety to Federation, as it gives him better yields and comes away faster, beating the wild oats better; it is early maturing, with a longer straw, but it is liable to shake. Mr. W. Batson grows a wheat known as Defiance, which he claims yields well, does not shake, with a strong, good standing straw. Messrs. Dahlenburg and G. Batson have introduced Melilotus for fodder, and on the latter farm nice little patches of lucerne testify to the possibilities in the future for this crop. Water is, of course, the secret of success for lucerne, but I believe there are great possibilities in the future for irrigation in regard to plots of lucerne, citrus fruits, and other forms of intense culture. Any visitor knowing what is done in other parts of the world is at once impressed with the large sheets of water in the swamps around Nhill. Swamp waters are quickly evaporated owing to their shallow nature, but why should this water not be caught and conserved in dams before reaching the swamp. A series of deep dams, one above the other, would not only catch more water, but would hold it longer, as deep water is not evaporated as fast as shallow, and from the dams it could be brought to the crop by gravitation. Thirty to forty acres of lucerne irrigated would supply an immense amount of fodder in dry times, and be the most practical insurance against drought. The establishment of citrus fruit growing would immediately enhance land values, as would vines for wine and raisin production, and this would apply to some of the now so-called poorer land for wheat growing.

The rotation systems followed were in most cases the same, and I am of opinion that in this respect an improvement can be effected, and I would strongly advise a trial of the following course:—

First year, fallow; second year, oats; third year, fallow; fourth year, wheat, and, as soon as possible, sow rape, rye, and peas.

The reasons for this course are:—

1st. That oats always yield better after fallow.

2nd. That oats and fallow rid the land from "take all."

3rd. That wheat follows oats better than oats follow wheat, because oats, being larger root makers, leave a better supply of organic matter decomposing in the soil. This means more nitrogen, and more phosphoric acid is released from the soil supply by oats than wheat, consequently bigger wheat yields can be expected.

If rape, rye, and peas were sown in the Autumn, a valuable rotation crop for restoring the soil, and releasing plant foods would be used, and a fine amount of feed for stock be supplied. The mixture gives bigger yields of fodder and a better balance ration than any of these crops sown separately, and as all three of the varieties are recognised useful rotation crops, good resultant effects must ensue. Very few attempts are made to keep up the supply of humus in the soil, and it has been found that land, especially that containing large proportionate quantities of sand, becomes liable to set hard, and loses its capacity for holding moisture, as the percentage of humus decreases, an important feature when dry seasons are experienced.

Seeing that these crops supply more humus through their larger root system as it decays, the effect must be good, and if, after feeding, they were allowed, in the Spring, to grow up to 6 or 7 inches and were then ploughed in, a supply of something like 4 tons of organic matter per acre would be gained. The soil would be more easily worked, and better supplies of nitrogen would result. It is a well known fact that wheat follows peas and vetches well, and bigger yields are reaped. There is also less danger of the land becoming sick, the change of crop being good for the land in this respect.

Crops and General Conditions.

The wheat crops, on the whole, were very much better than expected, and though most of them contained very large quantities of wild oats, they were almost free from disease altogether. Smut was almost an unknown quantity. There was no rust, and only a suspicion of "take all," in the crops inspected. White heads were fairly prevalent, and in patches some were tipped, but these conditions were not general. In the great majority of cases the heads were long, well filled from top to bottom, and it should not be at all surprising if the yield is better than anticipated, the sample of grain should be really good. The favorite variety is "Federation," next to which is Bluey—"Dart's Imperial," other varieties which showed up well being College Purple Straw, Viking, Yandilla King, and Defiance. It is a mistake, in the interests of the district, to confine the growers' attention too much to one variety, especially where there are local flour mills, and I would suggest that the introduction of further varieties, such as Bunyip and Marshall's No. 3, which should do well round Nhill, might be advantageous.

A judicious system of seed selection would probably improve the yield generally, and it is somewhat surprising that more is not done in this direction. The principle is applied as a matter of course in breeding live stock, and there can be no doubt that much can yet be done in regard to grain in the same way. The opinions of the leading men were, as a rule, against dry sowing, and no doubt they are right, as there is a better chance of a crop receiving no check if seeded when the land is in just the right condition; at the same time, if land has been well fallowed and worked to make the right seed bed and conserve moisture, the risk from dry sowing is not so great as is imagined, the worst feature being the possibility of weeds getting too much start, and this can be obviated to a large extent by harrowing after the crops are up—a practice that might be followed to a greater extent by many, the few that have followed this practice being fully satisfied with the results. Though some of the finest crops seen were very late sown, one of them in August, had the season been an early one instead of abnormally late, these crops would have been most unsatisfactory, and a big risk was taken in such late sowing. The amount of seed used, which appeared to give best results, was a bushel, and seeing that the late crops were best, this is explainable, as a man must seed heavily if sowing late. Seeding experiments in the past made by the Department of Agriculture go to show that, on the whole, a bushel gives best results at any time.

MR. C. H. TOWNS.

The popular and energetic secretary of the Nhill Agricultural Society to whom the success of the competition is due.

Pickling appears to be done haphazard, and, although no smut worth talking about was seen, more careful methods might be adopted, and a 2 per cent. bluestone solution used (2 lbs. to 10 gallons) being quite strong enough to kill the spores without the risk of injury to the grain.

Drake was fairly plentiful in some of the crops, and in others there was a considerable amount of rubbish in the shape of weeds, these all draw upon the supply of food and moisture that should go to the crops, and are evidence of bad management in the fallow and rotation systems.

OATS.

The oat crops were, with few exceptions, bad, being very dirty, and short, and many crops that would have been better cut for hay were left for stripping. I am firmly of opinion that generally better crops of both oats and wheat would result from the system of fallow oats, fallow wheat, for reasons already given.

A small paddock of Cape barley seen at Kaniva was sufficient proof that this crop can be grown successfully—the yield being about 9 bags per acre, and the sample fine, clean, and plump. Barley is a highly profitable crop, and might be worth more attention, and, though an exhaustive one as compared with other cereals, might come in with a rotation course.

MANURIAL NOTES.

The system of manuring was the same in each place visited on all kinds of soils, and for all purposes. A trial of bonedust on some of the sandy mallee soils might lead to good results, or a mixture of half bone, half super, also, on some of the heavy low land, a trial of Thomas phosphate would be advisable; both of these manures would need to be fairly heavy, the first year, say at the rate of 75 lbs. per acre, after which 50 lbs. per acre should be sufficient; this is due to their slower action in the soil. In both cases the after-effect on native oats and grasses would be of value. A change of manure has a good effect on the soil, too, in a general way. The present growth of natural feed is simply splendid, and this would be cut for grass hay in many districts as a provision against a bad time in the future. At present a large proportion of it is wasted, and is at the same time assisting to dirty the ground for the next crop.

MR. F. C. DAHLENBURG'S HOMESTEAD. 1ST PRIZE BIG FARM.

LARGE FARMS.

Mr. F. C. Dahlenburg, for his fine farm "Roseneath," Kiata, takes pride of place in this competition, practically every detail in his farm management being highly praiseworthy. His farm of 2,300 acres would be hard to beat anywhere. The system employed is good in regard to rotation and cultivation. He has also some fine wheat crops, and he does not confine himself to one variety only—his Purple Straw and Darts being very fine. Mr. Dahlenburg pickles with bluestone, and this year also, in one instance, used salt in addition with good results, the crop so pickled being certainly better in appearance than that pickled in the ordinary way. The oat crops, however, were poor. All seed is carefully graded and sown for wheat at the rate of 60 lbs. per acre. Nine hundred acres were under wheat and oats in all.

The fallow was generally good, but rather crusted in some paddocks.

The horses on this farm were particularly good, a fine even lot of good quality, and highly useful. Some of the mares showed exceptionally good quality. The stallion—a two-year-old—was a well furnished horse, showing good promise. Twenty-nine draughts, all in good order, all bay, make a beautiful picture, and are a very fine asset on the farm. Some good foals and two-year-olds coming on were seen to keep up the general status of this class of stock. The buggy horses and ponies were also in good order, and well suited to their work on the farm.

The sheep were also a nice lot, consisting of 800 merino and comebacks, even in quality, fine framed, and in good condition. A nice line of lambs was seen also. Mr. Dahlenburg is contemplating the use of comeback rams, followed by merinos, with a view to preserving size and heavy fleeces. This course is, I think, open to criticism, in that the use of crossbred rams will lead to a want of evenness in both frame and wool.

MR. F. C. DAHLENBURG'S FARM HORSES, 1ST PRIZE BIG FARM.

Cattle are a secondary consideration, but the nine cows seen were a useful mixed lot for dairy purposes.

The pigs were good farm sorts, and were well provided with styes and paddocks.

The fowls, White Leghorns, were good, and also were well housed in buildings which were kept whitewashed and clean.

A few turkeys, Bronzewing, were strutting round, evidently in blissful ignorance of the near approach to Christmas.

The farm equipment was very fine, comprising all that was necessary on a well-conducted holding. The machinery was well kept on the whole, and a credit to the general management.

Fences and gates, also drafting yards, were all in fair to good condition—the place being subdivided into no less than twenty-one paddocks—the water supply being provided with twenty dams, varying in size from 600 to 5,000 yards. Water is laid on to the house, garden, stable, and horse troughs, there being a fine watering trough in the large horse yard a convenient distance from the stable.

The homestead is beautifully situated and designed, being of brick, and containing fourteen rooms. Wide verandahs surround the house, and the whole is lighted by petrol air gas, as is also the stable and buggy shed. The house is beautifully kept, while the garden is perfect. The flower beds, paths, and lawns would be a credit to any town mansion. No less than ninety varieties of roses were seen, while flowers of all kinds were blooming in profusion. The orchard was in splendid order, the trees being good shapes, and the land well cultivated.

The vegetable garden was well stocked and nicely kept.

The outbuildings on this farm are numerous and good. A stable measuring 90 x 40 ft., roomy and high, with a convenient system for chaffcutting and supplying feed. A crusher through which grain is also passed before feeding giving the maximum value for the amount fed. A commodious grain shed, capable of storing 3,000 bags, good machinery, and cowsheds, and smaller buildings—all substantial and well ordered—make the farm look like a small township—a large oat bin on the silo principle being noticeable.

The system of fodder conservation adopted is a good one—a two years' supply ahead being the rule.

Tree planting has been done on a large scale, and natural timber belts reserved for shelter, lending an atmosphere of coolness and comfort, in addition to their practical usefulness.

Insurance is almost a dead letter with Mr. Dahlenburg, who says he prefers to do his own insurancing.

Mr. Geo. Crouch, of Kaniva, runs Mr. Dahlenburg a close second in this competition, and his homestead and buildings, though not on as extensive a scale, were comfortable and useful, and admirably kept. His system of cropping, rotation and cultivation, is practically the same as that generally practised. His farm crops, taken all round, are very fine, being very even so far as his wheat is concerned, and his oats were also better than many of those seen. Mr. Crouch is also experimenting with new varieties of wheat, but has not yet found anything to beat Federation. A small patch of Cape barley was being harvested, and, as previously mentioned, was particularly good. The fallow on this farm was undoubtedly the best seen.

In live stock, Mr. Crouch, although possessing a highly useful lot of horses in good order, does not come up to Mr. Dahlenburg in this respect; at the same time one cannot but be impressed with the care of his stock generally. The horses' feet were kept trimmed, the harness all in its place and in splendid condition, though some of it was twenty years old. The sheep were especially good sorts, very even, large framed, and showing quality. His cattle also were useful, and the pigs fair. A serviceable lot of fowls were running about.

The farm equipment was good, every implement, from the engine to the harrows, being kept in tip-top condition, well housed; ploughs twenty years old were true, and without a rock in them. Wire net doors were placed in front of the machinery sheds, no doubt a disappointment to the fowls, but a considerable advantage to the implements, which were all cleaned up and repaired before putting away for the season.

The fences, gates, and yards are all very good, the sheep yards being the best seen. The stable yard has been raised 12 inches, and was

in beautiful order. In all there were thirty-five paddocks, comprising 3,060 acres, making the subdivision very complete. Water storage is provided by seventeen dams, and water is laid on to the house and other important buildings, being lifted by windmills. Iron tanks are numerous.

The farm buildings reflect great credit for their serviceable nature and condition and general plan, a nice house, built for one son, in addition to the old home, being substantial and comfortable.

The wool shed is roomy and well fitted, stable good and lighted by gas, and other buildings in keeping.

In the orchard and garden sections Mr. Crouch loses points by comparison, the soil round the house being rather unsuitable for garden purposes, though it is the intention to establish a garden on another portion of the property.

The reserve of fodder was well managed and good, but on rather a smaller scale than might be advisable.

Tree planting might also be indulged in to a greater extent. Mr. Crouch insures more extensively than most of the farmers visited.

MR. HOFFMAN'S HOMESTEAD, 1ST PRIZE SMALL FARM.

I cannot conclude the description of this farm without special reference to the splendid general management shown, which is a fine object lesson to any one engaged in similar pursuits. Everything was well thought out and well done, and it will be noticed that in the more important branches of farming Mr. Crouch scores well.

SMALL FARMS.

Mr. Hoffman's farm of 900 acres is well situated, and kept in very nice order. Management is evident throughout. The homestead is well built and in good order, and well laid out. The stables and sheds are good, and everything in them cared for. A fine shelter shed for his cattle, built of bush timber and thatched with straw, struck me as being extremely useful for his cattle in hot weather.

The implements on this farm are well chosen and in good order. The system of cropping is much the same as that generally adopted, namely, fallow, wheat, oats, grass. Mr. Hoffman cuts a quantity of grass hay annually, and speaks highly of its value, the average cut

being half-a-ton per acre. A very nice stack was in course of erection at the time of inspection. The cocky chaff and straw was also not wasted, but carefully stored for use in bad times.

The men's quarters, though small, were neat and comfortable.

Fowl houses and yards were well built, roomy, and well stocked with first-class Leghorns.

The horses were better than are generally seen on small farms, including some fine mares and good foals.

There were no pigs, but, as a rule, a few were kept.

The fences were fair, but more gates would be an improvement. The wheat crops were good, and the oats were also good. The garden and orchard were small, but nicely kept.

The cows were as good as any seen, and dairying on a small scale is indulged in.

Taken all round, this is a nice farm, well managed, and a good example for others.

Mr. W. Batson, Porndeen, was under a disadvantage in that he has not had time to develop his farm of 374 acres, having only been two

MR. W. BATSON'S HORSES AND HOMESTEAD, 2ND PRIZE SMALL FARM.

years in occupation. He is, however, starting on right lines, and in the near future promises to be a hard competitor to beat. A nice homestead of Egyptian brick, of five rooms, well appointed, has been well built, with a garden just established surrounding; some nice young fruit trees are coming on. The fences and general subdivision is good, and a good barn and stable, well planned, has been erected. The water supply has been well thought out, but is capable of further improvement. The fallow is in good order, but on a smaller scale, naturally, than Mr. Hoffman's. His equipment, as far as it went, is good, and time will no doubt add much more machinery to the place.

There was a well stocked fowl yard, but fowl houses have not yet been given much attention.

Mr. Batson's horses were few in number, but well chosen and well cared for.

A good beginning has been made on this farm, and evidently careful thought is being given to each operation undertaken. Buildings are

and Mr. Batson is full of ideas for the improvement of the farm, which, however, will take time to effect.

It will be interesting to again visit this farm in the course of a few years to note the development which I feel sure will take place.

Best Crop.

Undoubtedly the best crop seen was that of Mr. R. F. Smith, of Kiata, grown on a black flat, and sown in May, which, last season, meant sown dry. The variety was Federation, and the amount of seed used 50 lbs. per acre, with a manurial application of 40 lbs. of superphosphate. The seed was pickled in bluestone.

Mr. Smith secured the seed from Dookie, and, provided no trouble is experienced in harvesting this crop, a splendid yield should result. The growth was very fine, being thick, strong, and even, the heads long and well filled, and the whole crop unusually clean and free from disease and weeds. An odd foreign head was visible, but these were few

MR. PETER BONE'S SECOND PRIZE WHEAT CROP.

and far between, and the wheat was very true to type. If Mr. Smith grades the seed, the whole crop should command a special value as seed wheat, more particularly seeing that the seed from which this actual crop was grown has so recently been brought from another district. I understand that it is the intention to hand pick the few foreign heads—a wise proceeding in this case. I do not think an estimate of 36 bushels excessive, and the owner is to be congratulated in having such a beautiful crop. It is shown on the cover block of this *Journal*.

Mr. Peter Bone, of Woorak, comes second with a fine crop sown in May, not so heavy as the first placed crop, but very even and clean in the bottom, well headed, and level as a board. This crop was sown dry at the rate of 60 lbs. per acre, with 50 lbs. of super. There were very few foreign heads, and practically free from wild oats, and, though not quite as heavy as some crops seen, will yield somewhere about eight bags.

Mr. Bone grows College Purple Straw and Marshall's No. 3 in addition to Federation, and speaks highly of both varieties. He harrowed his crop twice after it was up, which accounts for its cleanliness in the bottom, and also, possibly, for its general success. He is also a believer in the fallow oats, fallow wheat rotation. A nice crop of peas was seen on this farm, which was roughed in without a fallow, and sown at the rate of 1 bushel per acre, proving that peas will grow well and give a large body of feed for stock.

Mr. F. C. Dahlenburg comes third in this section for a very fine crop, which, though it will yield probably more than the second, was not as clean, and contained some foreign heads and a fair quantity of wild oats.

Many other good crops were seen in this section, the next best being those of Messrs. G. and H. Crouch and McKenzie, and so long as the district produces similar crops its reputation will not suffer.

Best Mallee Crop.

Mr. D. B. McKenzie takes first place in this section with a very nice crop of Federation, which should strip about seven bags, sown in July at the rate of a bushel, with 56 lbs. of super, pickled with bluestone. This crop, though on the short side, was thick and very well headed, also cleaner than all the Mallee crops seen, with the exception of Mr. R. Smith's, of Yanac.

Mr. F. W. Schultz, of Glenlee, is second with a very nice crop of Viking, which he claims is superior to Federation in many respects. This crop was not pickled, but showed no smut, and was even and regular. Wild oats were fairly thick, but the high habit of growth of this variety would be found an advantage during harvesting. It is, however, liable to shake, is very early maturing, and makes good hay.

Mr. Alf. Smith, of North Yanac, has a good crop, sown at the rate of 50 lbs. per acre, with 40 lbs. of super, seeded in April. This crop was very clean in the bottom, and free from wild oats, with no foreign heads. It was slightly tipped, and on the thin side, but should yield about five bags. The fact that this crop was grown on virgin country no doubt had a big influence on its clean condition.

Best Fallow.

The fallow on the whole was very even in character, the moisture condition being, of course, good throughout after the recent rains. Much the same system is adopted by every farmer, though some put more work in than others. Mr. Geo. Crouch, of Kaniva, showed a beautiful paddock of fallow, even and loose on the surface, with a fine firm seed bed, very clean, and not too fine or too cloddy.

Mr. Dahlenburg pushes him closely on points, but failed to beat the former owing to the somewhat crusty state of his fallow, which another working would rectify.

Mr. Keam also had a good fallow out. It was cloddy in places, and had some barley grass showing in patches. In several cases sheep had not been put on early enough, and the weeds were seeding; in others a stroke of the cultivator or harrows before harvesting operations came on would have been advisable.

The amount of fallow seen augurs well for the coming year's crop. The use of the scarifier harrow would be advantageous in some of the sandy soils, as it would have the effect of bringing the clods to the surface and letting the fine soil to the bottom, so making a better mulch and seed bed.

SUMMARY.

In conclusion, I should like to say that the opportunity given me of such a comprehensive run round the district has been very highly appreciated, and the quality of the land seen and general resources have left a deep impression of its value, both present and prospective. At the same time I should like to suggest that more attention towards the maintenance of the soils' productiveness should be taken than is apparently the case. The constant cropping with one or two kinds of crop only must tend to use up the available plant roots in undue proportion, and a system of rotation such as that spoken of would do much towards this end. This has been the experience in all the older countries of the world, and must follow here in due course. Prevention is better than cure in this respect, and the sooner steps are taken to bring about better systems, the less danger there will be of trouble. A striking example of the effect of farmyard manure, in which the humus supplied is probably the greatest value, was seen at Mr. G. Crouch's, where a patch of wheat stood out above all his other crops where the land had been treated to a top dressing of this class of manure. That there are old-established farmers in the district who are fully alive to these matters is beyond doubt, and it is very satisfactory to find that there are young men equally keen, with plenty of grit, coming on.

On the border of the great desert one case was met where a boy of fifteen had put in and grown a very nice crop of wheat, and showed the greatest interest in his work, and a desire for information that would lead to better prospects.

Another case of a young man who had come away from home and tackled the land, rather against his family's wish, and was making a success of farming, while, in yet another case, a man who was working for wages twenty years ago now had some 2,500 acres of land, worth £5 per acre, 600 acres of which were under wheat and oats, 500 sheep, and all the necessary appliances for conducting his farm operations.

These were cases that came under notice, and there are probably many others. All this goes to prove that not only is the land good, but there are some of the right men on it. The freedom with which all topics were discussed in connexion with farming pursuits was particularly pleasing, and the genuine hospitality shown greatly appreciated.

I should also like to take this opportunity of thanking those gentlemen who so kindly and generously lent their cars to expedite the work of judging, without which the time occupied would have been much greater and the work more arduous.

Mr. Towns, the Secretary, accompanied the judge on all occasions, and the Society is to be congratulated upon having the services of a man so thoroughly interested in its welfare, and success of these competitions which are evidently having beneficial effects on the farms and farmers of Nhill.

BEST BIG FARM, 1912.

Name.	A. Best System of Cropping, Rotation, and Cultivation.	B. Character, Condition, and Value of Farm Crops.	C. Condition of Fallow Area.	D. Live Stock.					E. Farm Equipment.	F. Fences, Gates.	G. Water Storage.	H. Buildings Arrangement, &c.	I. Orchard, Vegetable Garden.	K. Reserve Fodder.	L. Tree Planting.	M. Insurance.	Total.
				Pigs.	Horses.	Sheep.	Cattle.	Fowls.									
Points—Max.	35	20	20	5	25	20	10	5	20	20	45	20	10	20	5	5	
Dahlenburg, F. C.	30	14	17	3	22	15	7	4	19	14	38	20	10	15	3	1	227
Crouch, G. ..	30	16	18	2	18	16	7	3	17	17	36	18	4	14	2	3	221

BEST SMALL FARM, 1912.

Name.	A. Best System of Cropping, Rotation, and Cultivation.	B. Character, Condition, and Value of Farm Crops.	C. Condition of Fallow Area.	D. Live Stock.					E. Farm Equipment.	F. Fences, Gates.	G. Water Storage.	H. Buildings Arrangement, &c.	I. Orchard, Vegetable Garden.	K. Reserve Fodder.	L. Tree Planting.	M. Insurance.	Total.
				Pigs.	Horses.	Sheep.	Cattle.	Fowls.									
Points—Max.	35	20	20	5	25	20	10	5	20	20	45	20	10	20	5	5	
Hoffman ..	27	12	16	0	20	13	8	5	16	12	34	16	7	15	3	4	205
Batson, W. ..	28	12	15	3	18	10	5	4	14	14	30	16	6	11	3	3	195
Pohlner, H. A. ..	27	11	15	2	13	14	7	4	13	12	30	16	6	14	4	4	192

BEST CROP, 1912.

Name.	Freedom from Weeds.	Freedom from Disease.	Evenness.	Trueness to Type.	Apparent Yield	Total.
Max.	15	15	15	20	35	100
Smith, R. F. ..	13	15	14	18	35	95
Bone, Peter	13	15	13	17	30	88
Dahlenburg	12	14	11	17	32	86
Crouch, G.	11	15	10	18	27	81
McKenzie, D. R. (No. 2)	12	14	11	17	27	81
Crouch, H.	11	14	10	17	25	77
McKenzie, D. R. (No. 1)	11	14	8	17	24	74
Greenwood, W. G. ..	9	14	7	17	23	70
Werner .. .	9	14	8	16	22	69
Gladigan, and ..	8	14	7	16	20	65
McMillan, Wm. ..	9	14	7	12	20	62
Muir, Lawson .	8	14	7	12	20	61
Pohlner, J. F. A. ..	7	14	7	13	20	61
Pilgrim and White ..	8	14	7	12	18	59

BEST FALLOW, 1912.

Name.	Moisture.	Depth and Character of Mulch.	Freedom from Weeds.	Evenness.	Condition of Surface Clods.	Total.
Max. . ..	10	10	10	10	10	50
Crouch G.	10	9	9	9	9	46
Dahlenburg, F. C. ..	10	8	9	9	9	45
Keam, R. G. ..	10	8	8	8	8	42
McKenzie, D. R. ..	10	7	8	8	7	40
Hoffman	10	8	8	7	7	40
Muir, Lawson ..	10	7	7	6	8	38
Reichelt, C. F. H. ..	10	6	6	7	7	36
Pohlner, J. F. A. ..	10	6	6	7	7	36

BEST MALLEE CROP, 1912.

Name.	Freedom from Weeds.	Freedom from Disease.	Evenness.	Trueness to Type.	Apparent Yield.	Total.
Max.	15	15	15	20	35	100
McKenzie, D. R. ..	12	14	13	17	30	86
Schultz, F. W. ..	10	14	12	16	25	77
Smith, Alf.	12	14	12	15	20	73
Marshall, T., and Sons	10	13	11	15	20	69
Keam	10	13	10	14	20	67
Dart and Simons ..	8	13	8	14	17	56

THE FRUIT TRADE OF VICTORIA.

ITS PRESENT STATUS FROM A COMMERCIAL STANDPOINT.

(Continued from page 37.)

PART IV.

OVERSEA EXPORT TRADE.

By E. Meeking, Senior Inspector of Fruit.

Growth and Development of the Trade.

Prior to the year 1891 no continuous export of fruit from this State to countries oversea had been undertaken, although small lots had been previously exported by some growers from Harcourt and a few other districts at irregular intervals. In the year mentioned, however, the regular annual exportation of consignments commenced on a commercial scale, and has continued uninterruptedly to the present. The rapidity with which the trade has expanded has been shown in various reports which have been issued from time to time by the Department of Agriculture, and a detailed recapitulation is unnecessary. The graph shown hereunder should portray a more forcible realization of the total expansion than can be expressed in words. It may, nevertheless, not be out of place to furnish a detailed list showing how the industry has progressed during succeeding seasons:—

Quantities and Values of Fruit Exported to Oversea Countries from 1891 to 1912, inclusive.

Season.	Quantities.	Values. £
1891-2	1,638 cases	819
1892-3	3,308 „	1,654
1893-4	3,254 „	1,627
1894-5	8,388 „	4,194
1895-6	14,544 „	7,272
1896-7	22,010 „	11,005
1897-8	10,196 „	5,098
1898-9	15,248 „	7,624
1899 (May and June)	1,220 „	610
1899-1900	11,649 „	5,825
1901	36,050 „	18,025
1902	43,328 „	21,664
1903	87,993 „	43,996
1904	51,459 „	25,729
1905	58,511 „	29,255
1906	59,670 „	29,835
1907	139,009 „	69,504
1908	102,484 „	51,242
1909	204,678 „	102,339
1910	162,357 „	81,178
1911	297,400 „	148,700
1912	305,623 „	152,812

It will be seen from the figures of this list that for every 100 cases shipped in 1891, 19,062 cases were shipped in 1912. During the past five years (1906-1912) the expansion has been particularly rapid. This accounts in a large measure for the fact that the handling, transporting, and marketing arrangements have of recent years been altogether inadequate to keep pace with the increasing volume of trade.

THE IMPORTANCE OF PROPER HANDLING FACILITIES.

This absence of sufficient facilities for handling, transporting, and marketing the yearly output of our fruits is becoming an increasing disability to the trade each season, and is one which, if not quickly remedied, threatens to permanently retard the development of the industry, or, in fact, to imperil its very existence. The matter is one of national importance, for it must not be forgotten that the success of the immigration and closer settlement movements is largely dependent upon the development of the fruit industry on sound and profitable lines, as the business of fruit-growing is one which lends

itself to a successful occupation of small holdings perhaps more than any other branch of agriculture. A good income may be obtained from 10 to 15 acres of land bearing fruits of good marketable varieties. The pursuit, moreover, is one in which much of the drudgery and objectionable work connected with other forms of agrarian industry is conspicuous by its absence. In addition to these facts, it should be remembered that first class land is not necessary for raising good fruit, and that the problem of enabling settlers to embark in this occupation is simplified by the fact that the limited cost of the land is much less than is the case where the settler intends to carry out intense cultural methods connected with many other agricultural pursuits.

A large portion of our 12 millions or so of acres of Crown lands still inalienated is eminently suitable for fruit-growing, especially that portion which is classified as second class and auriferous, and as third class. If, however, the problems connected with the successful placing of our fruits on distant markets are ignored, very little benefit will be derived from the natural advantages which exist for the development of the industry, as its future welfare is dependent upon the rapid and

permanent expansion of the oversea export trade. So far, the handling, transportation, and marketing of fruits have never been specialized, as it has not been realized to the full that fruit, being a very perishable product, requires the application of unique methods for successfully placing it upon distant markets.

Before giving suggestions for improvements in the present methods, it will be desirable to outline those methods and to attempt to prove that a non-application of certain details in these is mainly responsible for the uneven and often unsatisfactory prices obtained during each succeeding season.

Inadequacy of Present Handling Facilities.

As long ago as 1898, Mr. J. Knight, the Departmental Expert on Fruit and Special Industries, who then had control of the examination of fruit intended for export, reported as follows:—"In my opinion a radical change is required in the present system of inspecting and packing green fruit for export. According to existing arrangements, fruit that has been inspected is simply placed on open wharfs alongside the vessel in which it is being shipped. Under such conditions it is really impossible to inspect the fruit in the thorough and systematic way that it ought to be done. A better system is urgently required, and I would suggest that a special receiving depôt should be established in Melbourne, provided with the necessary conveniences, to enable the work of inspection to be done thoroughly and expeditiously. Further, I would suggest that several provincial depôts should be formed in the principal fruit-growing centres. The adoption of this suggestion would enable many growers to share in the export trade who otherwise must hold back owing to the difficulties in the way.

"At these depôts the fruit could also be repacked and graded properly, growers being too often careless in these respects. The extra expense that would be incurred in carrying out my proposals could be fully covered by making a small charge per case for the fruit sent in. . . . . . Then, again, the knowledge that large quantities of prime fruit were passing through a metropolitan or other receiving depôt might probably be an inducement to English firms to become direct buyers, and this would be greatly to the advantage of growers."

Slow Improvements in Handling Facilities.

The above lines of argument were taken up by Mr. J. G. Turner, who was then Senior Inspector, Fruit, Imports and Exports, and who assumed control of the work of examination in the 1900 season. These have since been strenuously advocated by that officer and his staff; but, unfortunately, the matter has not been given the serious attention by growers, agents, and others concerned, which its importance deserves.

In the year 1907, owing to the rapid increase in the trade, it was seen that the matter of handling and presenting consignments for examination at the ship's side prior to their export had become too big a matter for the agents to handle successfully under the conditions then prevailing. The Department of Agriculture, therefore, obtained from the Railways Department a lease of a portion of one of the grain sheds at Williamstown, and also a lease of the old dumping shed at Port Melbourne, where consignments could be asembled, handled, inspected,

and adjusted prior to placing on board outgoing vessels. The work, which constitutes the most difficult portion of the business of fruit shipping, was carried out by the Department of Agriculture until the year 1912 as a temporary expedient until such time as the exporters should make arrangements for carrying out the work themselves, as it *was considered that the Department was incurring a large expense* which should rightly be borne by the exporters. It was, therefore, decided, in 1911, that the work in future seasons should be undertaken by the exporters themselves. This procedure was consequently adopted during the 1912 season, but the exporters were relieved of a portion of the burden by the Department stationing officers at certain of the country stations. Consignments from these stations were examined at time of despatch and consigned directly to the ship's side without further handling or inspection in Melbourne. Judging from results,

DEPARTMENTAL OFFICERS ADJUSTING CONSIGNMENTS.

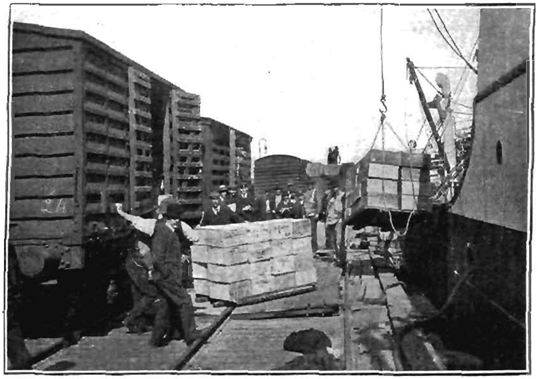
it cannot be said that the system has proved altogether satisfactory, as the matter of adequately inspecting consignments under these conditions is very difficult of accomplishment. As a consequence, the quality of the fruit marketed during the 1912 season left much to be desired.

DISABILITIES ACCENTUATED WITH INCREASING TRADE.

It will be realized to what extent the disabilities have intensified since the year in which Mr. Knight furnished the above report, when we consider that in that year (1899) only 12,869 cases were exported, and the present facilities for adjusting and handling consignments are little better than they were in 1899, although it is estimated that during the forthcoming season (1913) upwards of 400,000 cases will be shipped. The bulk of this total will be despatched within a period of some weeks, or an average despatch of 40,000 cases per week. This

average will, of course, not be uniformly distributed throughout the period, as, during certain portions of the same, 70,000 or 80,000 cases will sometimes be forwarded within the space of two or three days. This uneven distribution is unavoidable, as the sailing dates of the vessels, which must be arranged by the shipping companies with regard to their business as a whole, cannot be altered.

As the Railways Department does not possess sufficient trucks of a suitable type to cope with the rush of consignments, fruit is often despatched from country centres during the hottest portion of the year in any type of truck which may be available. In consequence, the fruit conveyed in such trucks often reaches the ship's refrigerator in an overheated condition. The Railways Department has been subjected to considerable censure by growers and exporters in connexion



LOADING FRUIT FROM LOUVRE TRUCKS.

with this matter; but consideration has not been given to the fact that the construction of sufficient trucks of a suitable type to meet the irregular rushes of consignments which take place within short spaces of time would, from a business point of view, be an unwise proposition, as a large proportion of these trucks would be standing unused in the yards during the greater portion of the year. Under present conditions, moreover, the full carrying capacity of trucks is not utilized, as many arrive at the ship's side incompletely filled. This tends to congest the traffic on the piers at Port Melbourne and Williamstown, and also entails an immense amount of unnecessary labour in shunting, handling, &c. At present the Railways Department possesses 690 trucks of the louvre type, and 170 ice cars of various types, for the conveyance of perishable produce.

It is considered that provision for an up-to-date receiving and

consignments, and improved methods of harvesting, packing, transporting, and marketing are the only complete solutions of the present troubles which beset the trade. The reasons for such belief will be given later on.

GOVERNMENT ASSISTANCE—BONUSES, LEGISLATION, ETC.

In addition to the before-mentioned assistance which the Customs Department has given the industry by handling and adjusting consignments for five years, a bonus of 1s. per case was given to exporters of fresh fruit by the Department of Agriculture in the early years of the trade to encourage the growth of the industry. Bonuses to encourage the export of fruit pulp, and also the planting of vines and fruit trees were provided. This system was inaugurated in 1890, and was continued until the year 1902, when it was discontinued, it being then considered that the trade was sufficiently well established to continue without assistance from the authorities. The amounts paid were disbursed as follows:—On export of fresh fruit, £12,395. On export of fruit pulp, £3,262. For planting of vines, £19,875. For planting fruit trees, £21,256. A total of £56,791 was consequently paid during the period in which the system was in force. It will thus be seen that the charge of neglecting to encourage the industry which has been levelled at the Commonwealth and State authorities is not borne out by facts.

In the year 1898 the Exported Products Act was passed, and all fruit, prior to export, was required to comply with the provisions of that measure. These provisions, so far as fruit was concerned, were simple—only demanding that fruit should be sound and free from disease, and the determination as to freedom, or otherwise from disease, was left to the Inspector. In 1906 this Act was superseded by the provisions of the Commonwealth Commerce Act, and since that time to the present fruit has been exported under the provisions of the latter measure. These provide that fruit must be in accordance with the trade description placed on the outside of packages. The provisions of this measure are not so simple as those of the old Exported Products Act, but they are not so efficient in preventing the export of inferior fruit as were the provisions of the older measure. It would appear that a mere trade descriptions Act is not exactly the type of legislation to effectively raise the standard of primary products, which seemingly requires special legislation of a technical nature to bring about the desired result.

(To be continued.)

A WELLINGTON paper states that the New Zealand "flax" industry is booming, owing to enhanced prices. One large mill would be clearing £2,000 per week. There are hundreds of small mills in New Zealand. This fibre plant (*phormium tenax*) thrives well in Victoria in suitable damp localities, and, in view of the demand ruling, attention may be directed to an article in this Journal of June, 1906, when instructions for the establishment of plantations were given. Since that date prospects have further improved by better methods of handling the leaf.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

Orchardists will be busy during February with the gathering and marketing of early and export fruit. In gathering fruit every care should be taken to see that it is not in any way bruised or crushed. This if often the cause of fruit decaying so rapidly and of the deterioration of fruit in the fruit-room. All fruit should be handled as lightly as possible.

Another point to be observed is the necessity for grading fruit for the market. *Grading pays, and it pays handsomely.* A buyer will never offer a good price for mixed grades, more especially as he will probably require to regrade it if he wishes to resell it. A good price will always be obtained for first grade fruit, while the low price offered for fruit of mixed grades can generally be secured for the lowest grade as well. The more exact the grading, the more profit for the fruit-grower; the more care in packing, the more returns for the producer; and so the greater care and exactness, the better it pays to grow fruit.

A final spraying for codlin moth will be necessary this month. Probably, owing to the irregular season, the moth has been more active during this season than last. The fallen fruit should all be collected and boiled, and all crevices and hiding places searched for larvæ.

The season has been favorable for the development of bryobia mite and woolly aphis, and, as soon as the fruit has been picked from the trees attacked by these insects, a good spraying of strong tobacco water should be given. This will minimize to a great extent the winter work.

Cultivation should still be proceeded with, and the soil kept in a continual condition of surface friability. This is especially necessary at this time of the year. Now that a good supply of rain is in the soil, it should be well conserved, so that the growing period of the trees may be continued until early autumn, when the trees should be allowed to ripen their wood.

Budding may be continued; and if an early start were made, the buds may be allowed to push their way out into growth, so that they may harden and be ready for pruning in the proper season. Buds that are placed in late season should be left dormant until the spring-time. Summer pruning may also be continued, and all superfluous terminal lateral growths removed, so as to strengthen the remaining buds and also to force out fruit buds for next season.

Fumigation.

Evergreen trees, including those of the citrus family that are infested with scale, should now be sprayed or fumigated to rid the trees of this pest. For spraying, a weak red oil emulsion, lime, sulphur, and salt spray, or resin wash will be found useful for the purpose. The most successful method, however, of dealing with the scale pest is by fumigation. The trees should be closely enveloped in an airtight

sheet or tent, and hydrocyanic gas should be generated inside. The chemicals for generating the gas, as well as the fumes of the gas itself, are excessively dangerous, and great care should be exercised in their manipulation. A wooden, enamel, or earthenware vessel is placed inside the tent, the vessel containing a mixture of 4 fluid ounces of sulphuric acid and 12 fluid ounces of water, the acid being placed in the vessel first. Four ounces of cyanide of potassium should then be quickly dropped into the vessel and the tent closed down at once; the bottom of the tent all round should be covered with soil to prevent any of the gas escaping. The operator must take care that not the slightest portion of the fumes is breathed. Fumigation should be carried out at night-time or on a cloudy day, and the foliage of the trees must be thoroughly dry.

Vegetable Garden.

The vegetable garden will require abundant water at this time of the year; liberal dressings and mulchings of manure will also be needed. These conditions, together with hoeing and soil stirring where necessary, are needed to produce succulent summer and autumn vegetables. All vacant plots should be well manured and deeply dug over in anticipation of the planting of winter and spring vegetables, the manure being worked in as deeply as possible. All vegetable and animal manures should be well rotted before being used for the garden.

Seeds of leek, Brussell's sprouts, summer cabbage, and cauliflower, carrot, turnip, parsnip, silver and red beet, peas and French beans may still be sown. Celery plants should be planted out into rows, and celery seed may also be sown for successive crops. Celery is a very popular winter vegetable, and it would be much more grown, if it were thoroughly understood. A bed of celery should be in every garden, and it is certainly very easy to produce. It is valuable as a salad, a boiled vegetable, and for flavoring soups; it is also a reputed reliever of rheumatic pains and affections. The seed should be sown from December to February, according to locality. It is best to sow the seeds in boxes or seed pans, covering them with glass to induce quick germination. The soil should be very fine and friable. When the young plants are from 1½ to 2 inches high, they should be planted out in boxes or in sheltered beds; and as they grow and become stronger, they should be planted out in their place in the garden. Rich, cool, and moist pulverized soil, well worked, and kept free from weeds, and careful attention, are all the requirements of the celery bed. The celery plants are generally planted out in trenches; and as they grow, earth is heaped up around the plant so as to thoroughly blanch the stems. An American method of blanching is to place a board on each side of the rows of celery plants, and secure them closely in position, so that as much light as possible is excluded. It is claimed for this method that it is a far cleaner way than the earth blanching; but the latter system produces a better quality of celery. There is a variety known as self-blanching, being naturally of a whitish growth. It is not to be compared to the varieties which are blanched by forcing, but it is very useful for soups and for flavoring.

Flower Garden.

The flower garden requires a maximum amount of water and of surface cultivation during the month of February. The season is generally a dry one, the air is hot and dry, and hot winds are sometimes prevalent; and it is impossible to expect that so many plants which are now flowering, will put forth their best efforts, without the aid of ample water and cultivation. The main autumn flowers, Cannas, Salvias, Dahlias, Penstemons, Chrysanthemums, and many plants of the herbaceous section, are now in full flower or are preparing to furnish their blooms. These will all require ample moisture, and in the case of rapid growing, succulent plants, such as the dahlia, a good mulching with stable or poultry manure is required. Flowering trees and shrubs, such as Oleander, Poinciania, Virgilia, Lagerstroemia, Acacia elata, and many others, are now in full bloom; and if the gardener has room for any of these, they should be noted for future planting.

Delphiniums should have their old flowering stems cut down, so that they may give another succession of autumn blooms. The plant should be well mulched and watered after cutting the old stems.

Carnations may be layered, keeping the layers continually moist and cool until they root. Cuttings of all pelargoniums, zonale and regal, may now be planted; a few spring bulbs for early blooming may also be planted; and seeds of perennial and hardy annuals may now be sown. Included among the seeds to be now sown are those of Sweet Pea, Wallflower, Iceland Poppy, Anemone, Ranunculus, Stock, and Pansy.

Beds and plots for the planting of daffodils, hyacinths, and other spring flowering bulbs should be thoroughly dug and worked over, and the subsoil should receive a good soaking.

Chrysanthemums should be thinned out, and staked, if this has not previously been done. The floral buds should be selected, and all others pinched out; and the plants should then be fed wherever necessary.

All old flower heads should be removed from the rose bushes. In March the plants may be thinned out, manured, and generally prepared in anticipation of the crop of autumn blooms.

All shrubs and trees that have bloomed should have their old flowering stems and shoots thinned out, so as to start fresh growths for filling in spaces, and for next year's blooms.

SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

Commencing 15th April, 1912.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during competition. April 15 to Dec. 14.	Dec. 15 to Jan. 14.	Total to Date (9 months).	Position in Competition.
40	White Leghorns ..	S. Brown	1,038	140	1,178	1
47	,, ..	J. E. Bradley ..	980	137	1,117	2
31	,, ..	G. Edwards ..	974	131	1,105	3
20	,, ..	E. Waldon ..	969	134	1,103	4
28	,, ..	F. G. Eagleton ..	988	112	1,100	5
62	,, ..	R. W. Pope ..	949	135	1,084	6
23	,, ..	W. McLister ..	976	101	1,077	7
37	,, ..	C. R. Bertelsmeier ..	925	142	1,067	8
9	,, ..	J. Spotswood ..	962	103	1,065	9
25	,, ..	R. L. Appleford ..	916	144	1,060	10
1	,, ..	J. Campbell ..	936	119	1,055	11
70	,, ..	C. J. Beatty ..	916	137	1,053	12
13	,, ..	W. B. Crellin ..	897	145	1,042	13
39	,, ..	W. G. Swift ..	900	132	1,032	14
49	,, ..	W. Purvis ..	886	133	1,019	15
33	,, ..	H. McKenzie ..	872	145	1,017	16
24	,, ..	*Sargenfri Poultry Yards*	889	124	1,013	17
45	,, ..	Wooldridge Bros. ..	868	143	1,011	18
38	,, ..	R. Moy ..	882	128	1,010	19
29	,, ..	J. B. Brigden ..	884	125	1,009	20
48	,, ..	Griffin Cant ..	887	121	1,008	21
14	,, ..	J. H. Wright ..	876	121	997	22
53	,, ..	H. Hodges	856	136	992	23
63	,, ..	Percy Walker ..	852	131	983	24
44	,, ..	A. W. Hall ..	863	118	981	25
50	,, ..	A. Alhpee	866	114	980	26
5	,, ..	J. H. Brain ..	828	138	966	27
46	Black Orpingtons ..	H. A. Langdon ..	889	76	965	28
7	White Leghorns ..	A. H. Padman ..	857	105	962	29
2	,, ..	B. Rowlinson ..	858	98	956	30
61	Black Orpingtons ..	Jas. Ogden ..	857	98	955	31
6	White Leghorns ..	J. B. McArthur ..	851	98	949	32
42	,, ..	Mrs. Kempster ..	811	126	937	33
19	,, ..	Cowan Bros. ..	810	124	934	34
10	R.C. Brown Leghorns	S. P. Giles ..	797	125	922	35
15	White Leghorns ..	Mrs. Steer ..	819	102	921	} 36
64	,, ..	H. Merrick ..	787	134	921	}
3	Black Orpingtons ..	King and Watson ..	850	69	919	38
35	White Leghorns ..	C. H. Busst ..	804	114	918	} 39
30	,, ..	Mrs. Stevenson ..	810	108	918	}
32	,, ..	S. Brundrett ..	777	140	917	41
69	,, ..	Morgan and Watson ..	781	135	916	42
51	,, ..	H. Hammill ..	788	108	896	43
56	,, ..	M. A. Monk ..	773	120	893	44
65	,, ..	A. H. Thomson ..	762	123	885	45
12	,, ..	T. H. C. Stafford ..	744	137	881	46
60	,, ..	Miss B. E. Ryan ..	767	98	865	47
43	,, ..	G. Purton	736	118	854	48
11	Black Orpingtons ..	T. S. Goodisson ..	735	110	845	49
54	White Leghorns ..	F. R. DeGaris ..	749	94	843	} 50
57	,, ..	B. Walker ..	724	119	843	}
66	,, ..	J. Moloney ..	694	139	833	} 52
27	,, ..	E. Nash	740	93	833	}
4	,, ..	J. Blackburne ..	719	112	831	} 54
41	,, ..	A. Stringer ..	728	103	831	}
8	Black Orpingtons ..	D. Fisher	735	78	813	56
16	Silver Wyandottes	R. Jobling ..	701	101	802	57
58	White Leghorns ..	W. J. Stock ..	704	95	799	58
55	Brown Leghorns ..	J. Mathieson ..	688	107	795	59
52	Black Minorcas ..	Chalmers Bros. ..	708	75	783	60
68	White Leghorns ..	W. J. McKeddie ..	662	118	780	61
21	,, ..	J. O'Loughlin ..	643	114	757	62
17	,, ..	S. Childs	618	128	746	63
67	Anconas	A. E. Manning ..	631	112	743	64
22	White Leghorns ..	W. N. Ling ..	638	102	740	65
59	,, ..	W. J. Seabridge ..	608	113	721	66
34	,, ..	R. F. B. Moore ..	587	102	689	67
18	,, ..	B. Mitchell ..	591	86	677	68
36	Old English Game	K. J. Barrett ..	574	96	670	69
26	.. .. ..	(Reserved) ..	—	—	—	..
		Totals ..	55,740	8,042	63,782	

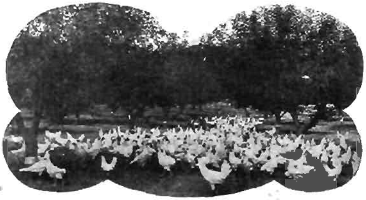
SECOND VICTORIAN EGG-LAYING COMPETITION, 1912-13.

H. V. Hawkins, Poultry Expert.

Report for Month ended 14th January, 1913—Nine Months.

The weather has been changeable, but not unseasonable. During the month 71 points of rain fell, followed by a hot spell; the glass steadily rising, and on the 12th and following day the temperature was 103 degrees and 105 degrees in the shade. The majority of the birds came through well, but a few felt the heat so much that their removal from the pens became necessary. One bird, in Pen No. 37, is still suffering from heat apoplexy, and has since been replaced. In the leading pen (Brown's), one hen strained herself, and was isolated for a few days, but not replaced. She is now back with the rest, and looks none the worse; also in Pen No. 2 one White Leghorn has been replaced. Broodies were not so numerous as in November. Mr. S. Brown's White Leghorns are still in the lead, with a total of 1,178 eggs; they hold a lead of 61 over the second pen, belonging to Mr. J. E. Bradley.

The feeding has been slightly altered—during the warm spell the meat ration being still further reduced, and additional green food added—principally thistles and raw onions. In the evening wheat has been the principal grain fed with a small quantity of short oats added.

A few birds are affected with bumble foot, due in part to the dry and hard nature of the soil, and the persistent jumping up at the gates when feeding. In many pens there is evidence of an early moult. The total number of eggs laid during the nine months was 63,782—an average of 924.37 eggs per pen.

On the previous page will be seen the results of the competition to 14th January, 1913.